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A STUDY OF CATERPILLAR TRACTOR COMPANY'S
EQUIPMENT INVESTMENT ANALYSIS METHOD

BY

FREDERICK G. TRUMMER, JR.

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A REPORT PRESENTED TO THE GRADUATE COMMITTEE
OF THE DEPARTMENT OF CIVIL ENGINEERING IN
PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF MASTER OF ENGINEERING

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The committee of three professors evaluating this project, named above, have provided constructive comments on this project's documentation which have been incorporated into the final draft.

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INTRODUCTION

This report is based on Caterpillar's "Equipment Investment Analysis III" (EIA III) program as a guide for further study of heavy equipment. The program was developed by John Gruebele, Fred Grafton, Bob Johnson, and Alex Forbes, of Caterpillar Tractor Company. References to "Equipment Investment Analysis III", or its abbreviated form, are taken directly from the program that is copyrighted by Caterpillar. The format presented in the Macintosh version of EIA III was copied from Caterpillar's program documentation and credit for it belongs to the developers.

The objective of Caterpillar in its development of EIA III is to assist their dealership network and prospective equipment purchasers in determining the best choice of equipment based on least total cost.

EIA III documentation claimed to be a "simple financial model that will provide:

- * The after tax owning costs of two alternate machines.
- * Operating costs per hour and total for the ownership period.
- * Production potential.
- * Net profit potential.
- * Costs per hour before and after tax.
- * Costs per unit of production before and after tax.
- * Total discounted cash flows."

This is a study of the EIA III program output and associated documentation that Caterpillar is providing to their dealership network. To determine the rationale of Caterpillar's approach, to determine if Caterpillar provides the above items to their dealers, and to determine

needed areas of improvement are the main objectives. Furthermore, to develop a similar computer model for the Apple Macintosh may prove useful in determining which variables of equipment investment are more sensitive to change. The EIA III program is written for IBM and compatible machines only, thus the program included in this report is based upon my investigation of the parameters and results of a test run of the LOTUS driven version.

The input values used in the Macintosh program were obtained from the Caterpillar EIA III documentation and do not reflect any information obtained by research of actual equipment historical records. The values were used so that the Macintosh EXCEL output results could be compared to those from the IBM LOTUS program in an effort to determine the correctness of program logic.

CHAPTER ONE EVALUATION OF CATERPILLAR'S METHOD

1.1 Overview

EIA III program documentation states that three different types of analysis may be performed with EIA III: "revenue potential, production potential (non-revenue), and discounted cash flow." The program uses four input screens after the analysis type has been selected. These input screens are "background, ownership, variable, and discounted cash flow." The background, ownership, and variable screens are 'required' with the 'discounted cash flow' optional.

Caterpillar's EIA III documentation is 90 pages in length; the first 25 pages are primarily instructions on IBM operations. Pages 26-47 describe the input of data into spreadsheets through command macros and customized menus. Pages 48-58 depict charts and graphs that may be used for presentations. Pages 59-73 are example outputs of the program's comparative analysis of two machines: a Caterpillar D9L and a Komatsu D375A-1. Pages 74-91 contain sample graphical representations of ownership and operating costs, example customer input sheets, and a glossary of terms.

1.2 EIA III Screens

This section states and briefly defines the input items that are utilized for the EIA III program. More in-depth descriptions of line items and terms used in the equipment analysis program are provided in the glossary starting at page 32 and the program formula listing starting at page A-5.

1.2.1 Background Data

The first input screen, entitled "Background Data," uses the following information. A brief description of each input item is provided.

- Prepared for: the name of the organization for which the analysis is being performed.
- Prepared by: the name of the individual performing the analysis.
- Equipment manufacturer: the name of the company that manufactures the equipment being analyzed.
- Equipment model: the model of the equipment being analyzed.
- Income tax rate: the percentage of income that a potential Caterpillar customer pays in income tax after tax deductible expenses.
- Investment tax credit %: the percentage of the equipment purchase price which is allowed as a direct reduction in taxes owed during

the first year of ownership.

- Investment tax credit factor: the percentage of the investment tax credit which is deducted from the selling price of the equipment when calculating the equipment's net capital cost for tax depreciation purposes.

- Resale tax rate: the percentage assessed against capital gains upon equipment resale.

- Insurance and local tax %: the percentage applied to the average equipment value over the ownership period which provides an estimate of the {insurance + local tax} expense.

- Resale inflation adjusted rate: the average inflation rate, expressed as a percentage, over the *previous* number of years (=expected ownership years).

- Revenue per unit of production: the amount of income per unit of equipment production defined as \$/hour or \$/unit quantity.

- Unit of production: the measurement unit used for production (cubic yards, meters, tons, etc.)

Except for the "equipment manufacturer", "equipment model", and "investment tax credit %", all "Background Data" input items are assumed to be the same for both machines.

1.2.2 Ownership Data

The second input screen, entitled "Ownership Data" uses the following

information:

- Ownership Period (years): the number of years the buyer intends to keep the equipment before selling or trading it.
- % Depreciation in Period: the total percentage of the equipment's net capital cost that the buyer can use as a tax write-off.
- Selling Price: the total delivered price which includes attachments, optional equipment, duty, freight, sales taxes, etc.
- Down Payment %: the percentage of the selling price in cash payment, if any, that the buyer pays to the seller prior taking ownership of the equipment.
- Trade-in Allowance: the value of a machine allowed toward the purchase of the new equipment.
- Book Value of Trade: the book value of equipment traded in for the new equipment.
- Finance Period: the time period in months that the consumer will finance the equipment.
- Simple Interest Rate %: the borrowing rate of financing the equipment.
- Resale Value-% of Sell: the percentage of the original equipment purchase price which when sold equals the resale price.
- Inflation Adjusted: the average inflation rate over the *previous* number of years (=expected ownership years).
- Annual Scheduled Hours: the total number of hours that the

buyer plans on operating the machine per year taking into account job efficiency and the ability of his operators.

- Availability %: the percentage of the total scheduled equipment operating hours which the equipment is expected to be in service.
- Hourly Production: the estimated production in unit quantity per hour.
- Fuel cost per unit: the amount of expense per fuel unit.
- Fuel unit: the fuel measurement unit.
- Operator salary: the total equipment operator's wages per hour, including insurance, wages, taxes, social security, housing, etc.
- Fuel consumed per hour: the quantity of fuel used per hour of equipment operation.
- Oils, filters, and grease: the cost per hour attributed to routine servicing of the equipment with oil, filters, grease, etc.
- Estimated tire life: the average tire life in hours.
- Tire replacement cost: the cost of a replacement set of tires.

1.2.3 Operating Cost Data

The third input screen, entitled "Operating Cost Data" uses the following information:

- Undercarriage:

 "I" factor: the undercarriage expense factor for structural *impact*, such as, bending, chipping, cracking, spalling, roll-over, etc.

 "A" factor: the undercarriage expense factor for track *abrasion*

 "Z" factor: the undercarriage expense factor for the combined effect on component life in the areas of environment, terrain, operation, and maintenance.

 Basic u/c factor: the *undercarriage* expense per hour under ideal operating conditions.

- Repairs: Extended Life Multiplier: the factor applied to the basic repair factor for estimated hours of use in excess of 10,000 per year.

 Basic Repair Factor: the average repair cost per hour over the initial 10,000 hours of use.

- Special Items: the estimated hourly cost of items not considered up to this point.

- Optional total cost per hour: the estimated total "operating" cost per hour for the equipment.

1.2.4 Discounted Cash Flow Data

The fourth input screen, entitled "Discounted Cash Flow Data" uses the following information:

- Debt % of assets: the debt to equity ratio of the prospective buyer's company.

- Cost of debt %: the simple interest rate at which the buyer's company borrows money for purposes other than the purchase of this equipment.

- Return on equity %: the desired rate of return on the customer's equity over the life of the machine.

- Availability:

(First year): the percentage of the total scheduled equipment operating hours which the equipment is expected to be in service for the *first* year.

(Last year): the percentage of the total scheduled equipment operating hours which the equipment is expected to be in service for the *last* year.

- Estimated inflation %: the estimated *future* inflation rate.

- Depreciation %:

(Year 1): the first year depreciation percent.

(Year 2): the second year depreciation percent.

(Year 3): the third year depreciation percent.

(Year 4): the fourth year depreciation percent.

(Year 5): the fifth year depreciation percent.

(Year 6): the sixth year depreciation percent.

(Year 7): the seventh year depreciation percent.

The four input screens comprise the EIA III user's input requirements with the program. Once the data is entered, the LOTUS program generates a variety of reports and charts. These IBM printouts are similar to the output created by the Macintosh version of the EIA III program that is shown at page A-19.

1.3 On-Line Notes

The following is a list of notes taken during an example run of EIA III on June 26, 1987 with an IBM XT personal computer equipped with one floppy-disk drive, one hard-disk drive, and an RGB monitor.

1. The program would not allow an input of the model number if a number was the first digit. When a leading number for input was attempted, exiting and returning to the worksheet was required.

2. When attempting to get into the "operating costs" worksheet, one must select "variable" under the menu item. No obvious reference to small procedures such as this were readily available to assist the user during data input.

3. The input sheet for "ownership" line items do not match the LOTUS template sheets causing confusion immediately upon starting to enter data. Replicating the on-screen worksheets in the input sheets seems more rational and would assist.

4. The model and manufacturer blanks were required to be input

on each worksheet; a simple solution to this would be to tie all worksheets to previous ones that have requirements for duplicated data.

5. When exiting the LOTUS template from the macro-driven program, one can easily end up directly in the master template. For the inexperienced IBM and LOTUS user, this 'nature' can cause some frustration.

6. The "help" items are not alphabetized.

7. In the final screen, "Discounted Cash Flow" cell contents, such as "N/A" or "ERR", may appear depending on whether "cost of debt" or "return on investment" line items are both or singularly input. Precisely what the program author had in mind here is not clear; however, a Boolean statement in each cell addressing the other cell to determine if an entry has been made would resolve the problem of error codes. An on-screen note to warn the program user of incorrect inputs would seem to be the most easily adapted procedure for this LOTUS template since the program is macro driven. Neither of these types of "user friendly" concepts are employed in the EIA III program probably due more to the operating system than to the authors' credit.

Furthermore, even if one has the correct input line items entered, error codes are still present if the number of iterations, required to get an unknown accuracy, is in excess of twenty. No reference is made to the amount of change that is acceptable between iterations. A means of entering the amount of change that is acceptable between iterations is required if one is to complete the analysis on the LOTUS templates in an

effective manner. In the Macintosh software used, EXCEL by Microsoft, the setting of the maximum number of iterations is available to the program user and no iterations for the discounted cash flow analysis are needed.

To be fair, a certain amount of bias exists toward a different operating system.

1.4 Input/Output

This section deals with the program input and output variables and problems. Since the Macintosh version of EIA III replicates the IBM version to a great degree, reference to either may be made. Relatively small and insignificant differences do exist between the programs such as: the Macintosh version is not macro-driven but keyboard entries are made directly onto the initial four input worksheets, the underlined items are the line items that can be entered, and information is entered once and transferred throughout the rest of the worksheet where needed.

1.4.1 Program Input Worksheets

The first input worksheet encountered is entitled "Background Data." The two items "revenue per unit of production" and "production measured in" seem better suited by definition to the "Operating Cost Data" worksheet. The remainder of the items should be among those in the "Ownership Data"

worksheet and no reasonable explanation is offered as to why a "Background Data" block exists.

The second input worksheet is entitled "Ownership Data". Again, this block consists of line items that are by definition "Operating Cost Data" line items such as: hourly production, fuel, operator, expendables, and tires. The remainder of the items are logically ownership items.

The third input block is entitled "Operating Cost Data" and is satisfactory.

The fourth input block is entitled "Discounted Cash Flow Data" and contains similar line items as those in the "Background Data", "Ownership Data", and "Operating Cost Data" blocks. The first three items, "Debt % of Assets", "Cost of Debt %", and "Return on Equity %" are by definition more suited for the "Ownership Data" block. "Availability %" is directly related to "Operating Cost Data" and "Estimated inflation %" and "Depreciation %" seem to be more suited for "Ownership Cost Data."

As mentioned before, the input sheets contained in the Caterpillar EIA III program documentation do not correspond directly with the on-screen input worksheets. Because of this problem combined with the illogic of the four titled worksheets, it will be recommended to Caterpillar Company, by receipt of this package, that they reduce their input sheets to "Ownership Data" and "Operating Data."

1.4.2 Program Problems

While studying the input line items in Caterpillar's documentation, one realizes several problems are working against the program user, or dealership, in the field.

- Problem number one is format. After one understands that no logical reason exists for dividing the input worksheets into four categories and that a variety of mixed categories exist in three of the four input worksheets, one finds that the program desktop contains many computed percentages and line item costs per unit that clutter the screen and detract from a professional presentation to a potential customer. The 'clutter' takes approximately one-half of each screen space and provides no benefit on the actual input screen. A more effective approach would be to extract the input information into the worksheets where the summaries are performed. The Macintosh version does not duplicate any non-essential formatting of the LOTUS templates. A concentrated effort was made; however, to make the Macintosh version 'appear' as closely to the IBM version as possible primarily so students using both computers feel comfortable transitioning from one system to another.

- Problem number two is definition combined with format. While working through the EIA III documentation, one encounters definitions with the example input screens. Some of these definitions are not contained in

the glossary, some of the definitions that are in the glossary are repeated word for word with no amplification, and some of the definitions are incomplete with specific direction to proceed to the "help option" inside the program if more information is needed. While reading the EIA III documentation for a better understanding of the investment assumptions that Caterpillar is making, it becomes apparent that assumptions are not expressed as such. For example, the "inflation adjusted resale value %" is computed, the only computation on the input worksheets, without reference to how the line item is calculated. This happens to be one of the more critical items in the program and no specific reference to its formula is made. Additional problems with the format occur in the "Operating Cost" worksheet of the IBM based program. Many items are able to be left blank, even if the line item is set equal to one. Since it is fairly standard practice to consider blank cells as zeros, the program can be particularly confusing to the unskilled spreadsheet user. Extracting tables and charts from the Caterpillar Performance Handbook referred to as CPH hereafter, would create a better understanding of factors, such as "extended life multipliers" that are numerically equal to one, if the scheduled equipment use is less than 10,000 hours per year.

- Problem number three is referencing. The EIA III documentation references the CPH for an explanation of many items used in the program, such as the "undercarriage cost" factors. While it is understood that this program is provided primarily to Caterpillar dealers,

it remains in the document's best interests for at least cursory definitions to be provided for all terms.

- Problem number four is separation. A special worksheet is made for "Discounted Cash Flow." Consideration of the time value of money is an integral part of any investment analysis and should not be an 'option'. For example, the financing interest expense paid over the life of the equipment has little meaning if the time value (or devalue) of money is not considered. The initial worksheets should tie in cash flow concepts with inflation values and expenditures for production, repair, etc. as those items of cost occur.

- Problem number five is redundancy. The EIA III program repeats previously entered information at the front of its output worksheets. One section, entitled "Operating Expense and Production Summary", repeated three quarters of its information already presented.

- Problem number six is priority. Over 35 pages included in the 91 page "Equipment Investment Analysis" package have nothing to do with equipment investment analysis. The 35 pages are literally dedicated to individuals who do not know how to turn the computer on. While major items such as 'how a different depreciation schedule might change the results' are omitted from the documentation, many pages are dedicated to images of IBM type computers with simple directions of how to operate the machine. It should be assumed that if someone is to utilize the IBM

machine and LOTUS templates, that individual should be familiar with computers at the most basic level.

1.5 Program Assumptions

The objectives of this Master's Project, as written in the introduction, are to determine the rationale of Caterpillar's approach, to determine if Caterpillar provides the stated items to their dealers, and to determine needed areas of improvement, if any.

The rationale of Caterpillar's approach to equipment investment may be effectively discussed by studying the assumptions, limitations, and capabilities of the program.

Assumptions were made concerning the income tax rate input as a single percentage since the variable was used for the entire program with no provision for its change over the course of the investment. The capability for the interest rate to be projected with a gradient may provide a better depiction of a growing business' income tax rate. The program further allows separate ownership years but does not allow separate 'average income tax rates' to be input for both machines. Even though the company analyzing the purchase may be the same, the average income tax rate over different ownership periods may be different. Since this tax rate is dependent upon the anticipated income over the ownership period, one approach to the problem might be to input the expected earnings and

deductions over the ownership period and thus have the income tax rate determined for each year. Anticipation of tax law would play a part here.

A most interesting computed line item is the "inflation adjusted rate %." The program determines an actual resale percent through 'discounting' the estimated "resale value-% of sell" by the estimated average prior inflation rate. The result is that the actual resale percent, used for the determination of the equipment's future resale value, will be lower than the estimated resale percent that would otherwise be used. In addition to this, the future value-to-present value of the equipment is further discounted with the use of the "estimated inflation percent" in the "discounted cash flow" block.

In the computation of the operating costs and production income, the availability of the equipment is estimated at an average percent for the duration of the ownership period. In the discounted cash flow worksheet, the availability is determined through the use of the straight-line method from the first-to -last year's input availability. Part of the problem with the entire first section of the EIA program is that the time value of money is not considered in the development of the production cost and revenue worksheets. The production costs per hour and costs per unit quantity are average equipment costs over the service life when these actual costs will be different for each year of the ownership period.

The operator salary is assumed to be the same for the two machines being analyzed. This may not be the case in those circumstances where the

machine's sophistication varies or where the physical size varies. The additional experience required to operate one machine may be a selling point for another machine that is simpler to operate and thus less costly.

The program makes the assumption that either the "cost of capital" or the "return on investment" may be utilized for the discounting of the cash flows back to present value. While the option of choosing between the computed "cost of capital" value and the input "return on investment" value is available, the assumption is made in the EIA documentation that the user understands the difference and that he can apply it. In the Macintosh version, the capability to enter an 'opportunity rate' or minimum attractive rate of return (MARR), was not provided. The "tax cost of capital" was the only discounting variable included.

The depreciation percentages are manually entered with no provision for entering the type of depreciation schedule. If the depreciation life were extended beyond seven years, the program would be unable to compute the total present value of the machine. Provisions to select one of many depreciation types should be available with the percentages automatically computed. The option should remain; however, to input depreciation values.

When I talked with the program author, I questioned why the first year cash flow worksheet failed to incorporate an ownership period of less than two years. Mr. Johnson stated that most people own equipment for two or more years. In my opinion, this limits the program's capability since if the

ideal life cycle is determined to be less than two years, either a different program or an adjustment to this program would be required.

Besides the assumptions discussed above, other limitations exist. The program is only meant for the IBM since it is a LOTUS template. As far as I have been able to determine, the program is not available for the Apple Macintosh. This could be a drawback for office networks using other-than-IBM operating systems.

The EIA program lacks gradients. The ability to input gradients for resale percent, production rates, downtime, maintenance, repair, and fuel consumption would be a benefit.

No means of evaluating equipment based on miles driven, vice hours operated, is available. It can be assumed that Caterpillar intended that this program be used for the analysis of equipment that operate on an hourly basis for maintenance scheduling. To be a widely applicable equipment investment program, the user should be able to analyze equipment based on many different parameters for many types of equipment. For example, how would one use this program if miles, instead of hours, were the measurement of use?

The format for the presentation of discounted cash flow is spread over several pages and should be condensed to a matrix. No benefit is apparent in presenting each discounted cash flow year on a separate page.

The unit costs do not take into account the factors involving the time-value of money. They are based on all the related input factors except

the cost of capital, yearly availability, future inflation, and potentially varying depreciation percentages per year. In my opinion, the total cost per hour should reflect the devaluation of the costs in the year in which the costs occur. An equal basis for comparison of two or more machines would then be capable of being performed.

1.6 Estimating Owning and Operating Costs

Equipment owners generally utilize equipment for the performance of tasks for profit. It is because of this profit incentive that machine users desire to achieve the optimum performance out of a machine. If optimum performance is thought of as the desired production at the lowest possible cost, then the decision of which machine to choose for a particular job becomes one of economics.

To decide which equipment is best suited, a rational and objective approach is needed in the evaluation of costs attributable to equipment use. A variety of options are available to the potential user; the following are among those that may be considered.

1. purchase
2. rent as needed
3. lease with option to purchase
4. contract out the requirement

The approach that Caterpillar has taken with their equipment

investment program is aimed primarily at the cash payment or financing of the equipment purchase. It is for this option that the EIA program provides its results and it is this option on which this report is based.

A rational method of evaluating investment costs for equipment involves the use of productivity values. Prior to any lengthy discussion on the generation of hourly costs, one should consider the following to name a few: the source of field data, how that data was obtained, if that data applies to a particular case under evaluation, if the data values are constants or variables, and if the data contain reference to intangible costs. Each of these considerations, if not applied appropriately, could induce error into the analysis. The glossary of this report explains what many of the variables mean and how they can be utilized in obtaining a more accurate estimate of hourly operating and ownership costs.

To be confident in the use of a program such as EIA, sufficient emphasis on long-term and accurate historical data is required in the following tangible areas at a minimum: the determination of allocable overhead costs associated with the maintenance operation, the determination of productivity values based on geographical location, type of terrain, operator skill, mechanic experience, type of soil, length of daylight, age of equipment, and the coordination of activities such that the expected equipment availability may be optimized.

Sufficient business experience is required as a balance on the equipment optimization team such that less easily defined areas or

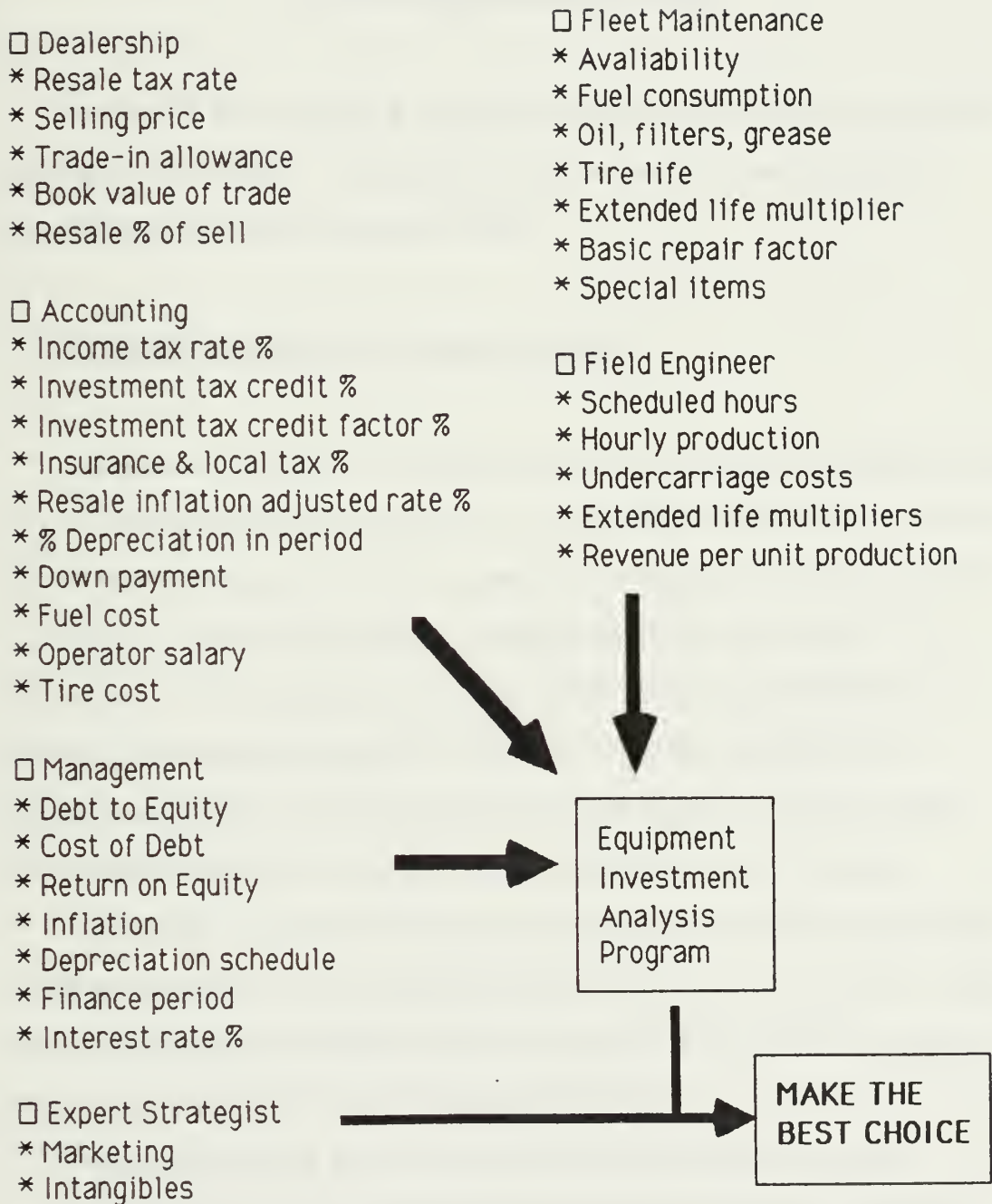
intangible items are considered. Some examples of these types of items, that can greatly impact the ability to keep a contractor and thus his machinery employed, are: visual appearance of equipment or 'perception' of newness, visual appearance or perception of equipment maintenance facilities, and responsiveness to contract durations or reputation to the owner in the face of increased costs through overuse. By considering these types of items and making decisions based on them, equipment costs can increase through 'unnecessary' maintenance for the effect desired by management.

An area that is perhaps the weakest among contractors and possibly among the most important, is that of financial management. The identification of optimum ownership periods, finance periods, investment opportunities, and marketing strategies in an effort to maximize cash flow are some of the areas that can have a great influence on equipment fleet cost.

Production evaluation methods through accurate record-keeping, consideration for intangible costs, and financial management strategy are three areas that contribute to the actual cost of heavy equipment and they are areas that require different experience in order that the 'investment team' work effectively.

To graphically represent this concept, the following page shows a flow diagram of variables into the EIA program.

1.6.1 Flow of Variables



CHAPTER TWO

CUSTOM PROGRAM DEVELOPMENT

As part of this project, a computer program was written using EXCEL software by Microsoft. The computer system used for developing the program was an Apple Macintosh 512KE.

2.1 Macintosh Equipment Investment Program

Located at Appendix A are three groups of printouts: Cell Name Listing at A.1, Program Formula Listing at A.2, and Program Output at A.3. The cell name listing reveals the defined names that are used in the program logic statements. Beside the names are expressions "1&2" or a blank. The expression "1&2" indicates that the value for the cell name could be different for equipment model 1 or model 2. The use of names in a spreadsheet program can be more time-consuming but provides a more clear understanding of the program logic when evaluating formulae.

Following the cell name listing is the program formula listing. This document contains the formulae and logic statements for model one. Model two's formulae are the same with the exception of the 1 or 2 that might be required as discussed in the previous paragraph.

Program output at A.3 is an example run of the entire program including graphics. This sample run includes the input values used by

Caterpillar in their sales training package.

A second run of the IBM program was performed, with all input blanks used, to ensure that the computational logic of the program was precisely the same as the EIA III program. All intermediate and final values matched the EIA III program to the hundredth place.

All blocks that are used for input are in the first two pages of the program output and have an underline. When inputting values into the Macintosh spreadsheet, only input cells are allowed to be changed. All other cells are locked; the program is passworded.

2.2 Sensitivity Analysis

A sensitivity analysis on all input variables was performed in an effort to determine the ten most sensitive to change. Tabulations of the results of the analysis are located at Appendix C Sensitivity Analysis Results, specifically C.1 Tabulations. The sensitivity analysis procedure utilized is listed below in the steps performed:

-
- Determine baseline values for all input variables,
 - Determine the magnitude of all variables at 80 percent of the baseline value,
 - Determine the magnitude of all variables at 120 percent of the

baseline value,

- Execute the program and record the results after each run,
- Determine the magnitude of the variation of each recorded

variable's value from the baseline value,

- Determine the percentage of the variation of each recorded variable's value from the baseline value,

- Determine and sort by high-to-low the total variation in dollars from the baseline value,

- Determine and sort by high-to-low the percent average variation from the baseline value, and

- Scale the ten variables most sensitive to the overall change.

The purpose of using a scale was to facilitate graphing the most sensitive variables. The scale was defined relative to the tenth most sensitive in which all more sensitive values were divided by the magnitude of the tenth most sensitive value in each category evaluated. The categories evaluated were:

- Total present value,
- Average after-tax cost per hour, and
- Average after-tax cost per unit quantity.

By referring to the final sensitivity analysis tabulation located at page C-10, the following relationships are apparent:

- For the total present value, the "revenue per unit of production"

and the "hourly production" were the most sensitive to change and were five times as critical, per percent of change, as the "return on equity."

- For the average after-tax cost per hour, the "income tax rate percent" was the most sensitive to change and was approximately ten times as critical, per percent of change, as the "down payment" and combined undercarriage factor ("Z" factor).

- For the average after-tax cost per unit quantity, the "hourly production" was thirteen times as critical, per percent of change, as the "availability."

Of interest is the observation that the only 'top ten' variable common to each of the three categories evaluated was the "income tax rate." The most important result from an analysis such as this is the importance of teamwork in the business. For example, referring to the last page of the sensitivity analysis tabulations, one sees that the "revenue per unit of production" and the "hourly production" are the two most significant variables for the generation of profit. The "annual scheduled hours" and the "availability" are so close in criticality, that they can be grouped within the four combined. Effecting solid marketing strategy by knowing what the competition's pricing is and what the highest price is, that the market will withstand, is equally as important as achieving the most production out of equipment in the field. The "annual scheduled hours" and the "availability" of the equipment, each directly tied to the fleet manager and the mechanics, are as important as the first two mentioned. Looking at the

fifth overall most sensitive variable, in the "top ten" present value table, is the ownership period. As the ownership period increased, so did the present value indicating that selling earlier than planned, under a selected depreciation schedule, may be unwise. It can be seen then, that the determination of the optimum ownership period, or "optimum equipment life" (Collier and Jacques), is critical to the generation of profit or to obtaining maximum benefit from equipment.

In addition to tabular form, the results of the sensitivity analysis are presented in graphical form at Appendix C, C.2 Graphs. The graphs are formatted such that the y-axis contains the ten most sensitive variables for each category evaluated. The order is from top (least sensitive) to bottom (most sensitive).

CHAPTER THREE

PROGRAM USEFULNESS

This section deals with the correspondence from and to the author of the EIA program and with the dealers that utilize the program.

3.1 Correspondence

Located at Appendix B.1.1, First Letter to EIA Author, is a letter to Mr. R.A.L. Johnson. The initial letter, not included in this report, was sent to him during the first week of June and stated questions regarding how some of the variables in the EIA III program were computed. A phone call was received from a Caterpillar lawyer who indicated that a formal release would need to be signed by me prior to further assistance by Caterpillar.

After assuring the lawyer that no commercial intentions were involved and after stating that I did not have access to any program formulae, the lawyer agreed that further legal involvement was unnecessary.

Upon Mr. Johnson's receipt of the second letter at Appendix B.1.2, Second Letter to EIA Author, he contacted me at home on the evening of July 10, 1987. At page B-3, is a brief synopsis of the telephone conversation in which discussions took place on how the "inflation", "cost

of capital" variables, and others were computed.

Mr. Johnson responded to my request for names of dealerships with the letter at page B-4. He listed the names of fourteen Caterpillar dealerships that have been introduced to the investment program in the past.

3.2 Questionnaire

A cover letter and questionnaire were prepared and mailed to the fourteen Caterpillar dealers, listed in Mr. Johnson's letter; the survey was performed in an effort to determine the extent to which dealerships employ computer techniques in evaluating equipment investment alternatives. The results are contained below with the topics abbreviated for space considerations. The questionnaire, in its original format, is at page B-8 and dealership responses start at page B-9.

3.2.1 Questionnaire Results

<u>Yes</u>	<u>No</u>	<u>Other</u>	<u>Topic</u>
			1. Discounted cash flow consideration prior to:
6	6		A. Deciding to purchase?
11	1		B. Assisting customer in purchase decision?
12			2. Computer utilization for analysis.
			3. Type of model used.
12			A. EIA program?
3	5	4	B. Local program?
	6	6	C. Other commercial program?

Scale

1	2	3	4	5	4. Computer equipment usefulness on a scale
0	2	5	5	0	of one to five: five equals most useful.

The questionnaire results indicate that computers are used at each Caterpillar dealership that responded. Mr. Johnson provided an address for fourteen: twelve answered the questionnaire. It was known prior to sending the questionnaires, that these firms had been introduced to the EIA program; the questionnaire results indicate that the dealerships have not given up its use for manual methods.

Two firms responded with narrative comments indicating that, except for large mining companies and other companies of similar size, the use of EIA is limited due to two reasons. The first reason is that sales personnel are not trained in discounted cash flow concepts or on IBM computer operations and the second reason is that small business customers have little, if any, knowledge of investment analysis techniques. One firm, from Canada, indicated that companies using financial models generally "own 50 or more machines." This implies that firms with less than 50 machines do not employ investment analysis models for financial strategy.

I found the even spread of responses to question 1A interesting. One-half of the dealerships stated that **they** do not perform discounted cash flow analyses in their equipment decisions but yet ninety-two percent stated that model concepts assist their customers in the purchase decision.

Thirty-eight percent, of those responding, indicated that locally prepared computer programs are used. No dealerships that responded, use any type of commercial program for equipment analysis.

From Mr. Johnson's conversation with me and from my conversations with local contractors, it is apparent that construction contractors, investing in large equipment, generally do not consider the time-value of money.

CONCLUDING REMARKS

The seven items, listed in the introduction to this paper, are provided by Caterpillar's EIA III program. The program definitely provides a rational basis for comparison for two pieces of heavy construction equipment through the use of the discounted cash flow analysis. While the comparison of unit costs may be representative of the relative economy of the equipment being compared, the values, other than the present value totals, may be incorrectly relied upon for actual costs per hour (ownership and operating) due to the fact that no discounting is used in the computation of those costs per hour. This applies to the revenue and profit values also.

In a more general nature, Caterpillar's approach to analyzing equipment investment alternatives is adequate for the purpose for which it was intended: to be a training aid for sales personnel in the field. Rather than mandate the use of discounted cash flow concepts, the program and accompanying documentation affords the program user the opportunity to perform a cost analysis with and without treatment for time devaluation of money. For a truly comprehensive equipment investment package, Caterpillar should consider using many of the items discussed, such as gradients and the optimum life cycle method.

GLOSSARY

Annual operating hours:

The [total number of expected (or scheduled) hours that the equipment is planned for use on an annual basis] X [the availability of the equipment during that period of time].

Annual scheduled hours:

The total number of expected hours that the equipment is planned for use on an annual basis, assuming ideal conditions (EIA).

Availability:

Usually expressed as a percentage of time that the equipment will be available for production; this factor will normally decrease as the equipment ages due to increasing repairs and associated downtime; may be expressed as a gradient or straight-line; should be linked to the number of hours of equipment operation instead of the number of years of ownership; should be linked to a subjective evaluation of the maintenance program's efficiency.

Basic repair factor:

The repair cost per hour for equipment that includes repair costs except the following: buckets, ground engaging tools, undercarriage, tires, chopper blades, tamping feet assemblies, labor for daily and periodic maintenance, supplies for periodic maintenance, fuel, oil, grease, service truck mileage costs, servicemen's travel costs, machine transportation to and from shop, technical analysis, scheduled oil samplings, operators, risk, insurance, inflation, and attachments; based upon the first 10,000 hours of service,

parts costs published by the U. S. Consumers List Prices, and labor at a total of \$40.00 per hour (EIA).

Book value of trade:

The estimated market value of the equipment offered in trade for the new purchase; may be used to offset the "trade-in allowance" in the calculation of "capital cost" if allowed by tax rules.

Book value:

The estimated market value, for tax treatment purposes, of the equipment; [the depreciable percent remaining in the equipment's depreciation life] X [equipment's initial purchase price minus the difference in the trade-in allowance and the book-value of the trade-in]; may or may not be representative of the equipment's actual market value.

Capital cost:

= Selling Price - Trade-In Allow + Book Value Trade; can be thought of as the acquisition cost of the equipment (EIA).

Cost of debt:

The "percent cost of debt" is the simple interest borrowing rate of the equipment purchaser's organization; the "cost of debt" is defined by EIA as:

= Debt percent of Assets X Percent Cost of Debt X [1 - Income Tax Rate]; used in the computation of "Cost of Capital. "

Debt % of assets:

The debt-to-equity ratio of the equipment purchaser's organization; an important measure of the relative amount of equity held by owners of the organization; on a company's balance sheet, = Total Liabilities + Total Net Worth; the maximum acceptable debt-to-equity ratio is two to one which means that the creditors have twice as much invested in the company as do the owners;

if this ratio is less than one, then the company has a strong equity position but is hesitant to finance debts (Jackson and Gilliam pp. 53-54); entered into the program as a percent, $= 100 \times \frac{\text{Total Liabilities} + \text{Total Net Worth}}{\text{Total Liabilities} + \text{Total Net Worth} + 1}$.

Depreciation:

The amount of money that can be deducted from a company's gross taxable income due to the equipment's book devaluation; $= \text{Net Capital Cost} \times \text{Depreciation\%}$; Two reasons exist for the use of depreciation: *1. To provide equipment owners with an approximate market value of the equipment over its depreciation life and *2. To provide the maximum tax benefit; since the two philosophies are quite different, companies may use a double accounting system, one for tax purposes and one for management purposes (Collier and Ledbetter ch. 16); the type of depreciation method used in the program sample run was a five-year accelerated cost recovery schedule (ACRS); although the Internal Revenue Service provides guidance on the allowable percentages for depreciation each year, the annual depreciation may be normally found by calculation of two of the four existing methods: straight-line and declining balance.

Discount factor:

The decimal number that when multiplied by the future value cash flow equals the present value; $= 1 \div [1 + \text{Tax Cost of Capital}]^{\text{Year } n}$ (EIA).

Discounted cash flow:

A future cash flow that has been 'discounted' back to present value; is calculated with the company's "Tax Cost of Capital" or could have used the company's percent rate of opportunity (MARR) by:

$= \text{Future Value} \div [1 + \text{Tax Cost of Capital}]^{\text{Year } n}$ (EIA).

Down payment:

The amount of advance payment, made to the seller, that is deducted from the total equipment's total selling price.

Equity:

The net worth of the equipment at a point in time; equals the equipment's resale value minus all cash flows necessary to sell the equipment.

Estimated inflation:

Expressed this way in the discounted cash flow worksheet of the EIA program and is the estimated future average inflation rate projected over the ownership period; the inflation percent is the rate of decline in the purchase power of money; assuming that a piece of equipment n years ago is the exact same physical machine today, the estimated average past inflation rate is: $= [\text{Current Selling Price} + \text{Past Selling Price}]^{1+n \text{ years}}$.

Estimated tire life:

This is the average tire life, in hours, of a set of tires (EIA); "the proper selection, application, and maintenance of tires continues to be one of the most important factors in earthmoving economics"; factors that can have a major impact on equipment productivity are climatic conditions, operator skills, maintenance practices, load, terrain as related to speed limitations, and terrain as related to tire quality or toughness (CPH p. 535).

Extended life multiplier:

A factor that is multiplied by the basic repair factor to get the total repair cost per operating hour; applied to the basic repair factor if the equipment is expected to remain in production more than 10,000 hours during its ownership period (CPH pp. 515-523); if used, it essentially provides an

average repair cost over the ownership period, with expectedly higher costs earlier in the service life; should be applied as a gradient over time so that more realistic costs per hour are achieved; should be tied to a data base of historical records.

Finance period:

Defined in EIA program in years; for a better depiction of the affect of change in the finance period, one should link a change in period with a corresponding change in interest rate due to a lending institution's ability to get the use of their money quicker than would otherwise be; with a change in finance period, all other factors that may normally change, should be changed concurrently in an effort to ascertain the corresponding change in sensitivity.

Fuel consumed per hour:

As in estimating costs of most variables, fuel consumption rate can be determined in more than one way: historical field data and estimating tables; when evaluating machine cost, ensure that the fuel consumption is linked to all other variables such as cumulative hours of operation (not just service life in years); a gradient might be used here if field data supports it; operator skill, temperament, and attitude toward the machine can have up to a twelve percent difference in consumption rate (CPH pp. 498-499); can be good indicator to a fleet manager of the need for repair prior to breakdown.

Fuel cost per unit volume:

In this analysis, is the cost per measured unit which is normally gallons.

Ground engaging tools:

This EIA program line item that accounts for equipment components that

drag in the soil such as rippers, buckets, blades, and scarifiers; entered into the program as a cost per hour; according to the assistant fleet manager at the Alachua County Public Works Department, these components are normally not covered under warranty; usually these items are designed for quick replacement due to anticipated rapid wear.

Income tax rate:

This line item is the federal income tax rate paid; can be the *incremental* or *average* tax rate; if the incremental tax rate method is employed, the income tax rate becomes the highest rate applicable on the tax return amount plus the original taxable income amount; if the average tax rate is employed, the income tax rate becomes: $= 100 \times (\text{Total Tax} + \text{Taxable Income})$ (Collier and Ledbetter ch. 15).

Inflation:

The result of a decrease in earnings relative to an increase in the costs for a product; the consumer price index provides listings of the market values for normally purchased goods; the labor standards index provides listings of changing labor wage rates over time and can be used for evaluating the cost of inflation; see "estimated inflation".

Insurance and local tax:

As used in EIA, this is the amount of insurance plus local tax expense allocable to the equipment; this amount in dollars per hour can be found by:
 $= [\text{Average Insurance Expense/Year} + \text{Average Property Tax/Year}] \div \text{Hours per Year}$; the "insurance and local tax" may be computed by: $= [(\text{Delivered Price} \times (N + 1) + 2N) \div (\text{Hours per Year})] \times [\text{Insur}\% + \text{PropTax}\%]$, where N=number of years (CPH p.498);

$$= \left\{ \frac{[\text{Selling Price} * (\text{Own. Yrs} + 1)] + [\text{Est. Resale} * (\text{Own. Yrs} - 1)]}{(2 * \text{Own. Yrs})} \right\} * (\text{Ins. Tax \%} / 100) * \text{Own. Years.}$$

Interest:

The cost of financing the equipment; interest is equal to the average hourly equipment price X interest rate: = $\{[\text{Delivered Price} * (N + 1) \div 2N] \div (\text{Hours per Year})\} * (\text{Interest \%})$ (CPH p. 497); the EIA program used an amortized interest payment: = $P(A/P, i, nXn) - P$, where P=selling price, n=number of months of financing, and i=simple interest rate; using the CPH 'average cost' method, the interest rate equals approximately twice that calculated from a typical bank loan; it is recommended that the lending institution's finance rate be used or if the equipment is owner financed, use the company's opportunity rate for investments; there are three types of interest rates: actual, nominal, and effective; the actual interest rate is the rate at which interest is compounded at the end of the specified period, regardless of the number of compounding periods in a year; the nominal interest rate is the *annual* interest rate for which the yearly rate is linearly proportional to the rate if specified for less than a year: 1%/month actual equals 12%/year nominal; the effective interest rate is the *annual* rate including the effect of compounding periods: 1%/month actual compounded monthly equals $[(1 + 1\%)^{12\text{months}} - 1] = 12.68\%$ /year effective (Collier and Ledbetter ch.2).

Investment tax credit:

An amount that directly reduces the federal income taxes owed in the first year of equipment ownership; dependent upon tax law as to whether this is an allowable item and to what extent if it is allowable; is an economic

incentive to modernize equipment fleets by allowing contractors to save on taxes if new machines are purchased (Collier and Ledbetter p. 315); the "investment tax credit percent" is stipulated by tax law and is applied to the "capital cost" in the year allowed; the "investment tax credit factor" is a percent applied to the "investment tax credit" that directly reduces the "net capital cost" at the time of resale which in turn results in a smaller depreciable investment (EIA); may or may not apply depending on the tax law.

Minimum attractive rate of return:

The cutoff point for acceptability of an investment's rate of return; "investment opportunities yielding less than the **MARR** are considered *not* worthwhile" (Collier and Ledbetter p. 199).

Mechanical availability:

This term is used in the EIA documentation to differentiate between the average availability, used in the non-discounted cash flow section, and the straight-line decreasing availability, used in the discounted cash flow section; the percentage of the scheduled operating hours during which the machine is producing; according to EIA notes, the following should be considered in the availability analysis: parts availability, ease of service, field service, and durability.

Net capital cost:

The total equipment cost that is used for the determination of depreciation; = Selling Price - Trade-In Allowance + Book Value of Trade - [Investment Tax Credit X Investment Tax Credit Factor] (EIA).

Oils, filters, grease:

This hourly amount can be determined by maintenance records or by using tables (CPH pp. 505-508).

Operating cost:

The cost of equipment field operation that includes all expendable, parts, operator, and repair costs; as seen in the program sample run, the operating costs are over one-half of the total after-tax cost per hour.

Operator salary:

The equipment operator's total salary which includes wages, taxes, social security, housing, and other fringe benefits.

Optional total cost per hour:

The total *operating* cost per hour (EIA); if entered, will take priority over all other associated line items involved in the computation of the hourly operating cost.

Ownership cost:

Includes the line items of cost for equipment that would accrue even if idle and unproductive; for those items in which there is linked cost, such as trade-in allowance tied to total hours of use, it is up to the evaluator as to which category trade-in allowance belongs.

Ownership period:

The period of time, in years, that the machine is expected to be owned and in service; this item is not necessarily the same as finance period; should be determined by a computer evaluation of the 'optimum life cycle.'

Present value:

The value of any cash flow that has not experienced interest or inflation; discounted future value; $= \text{Future Value} / (1 + i)^n$, where n =number of periods and

i=the discount interest rate.

Production measured in:

The unit of measurement for production; it is important to ensure that the "hourly production" units are the same as this line item.

Profit:

As a general definition, this is the amount of monetary gain remaining after all costs, direct and indirect, are deducted from the investment income (Guralnik p.1135); equals the "net profit" in the EIA program.

Resale inflation adjusted rate:

This is an inflation rate used to adjust the "resale percent of sell"; this term, as named, is peculiar to EIA and its author as far as could be determined; the average percent inflation rate over the previous number of years equal to the expected number of future ownership years.

Resale tax rate:

The percent rate of taxation on capital gains; varies with tax law; in the EIA program, if left blank, will use the "income tax rate" on the taxable profit received at resale.

Resale value-% of sell:

"The percentage of the original equipment purchase price which when sold equals the resale price" (EIA); an example: if a machine demands \$100,000 five years ago and sells for \$30,000 today, then the "resale value-% of sell" is thirty percent.

Resale value-inflation adjusted rate:

The resale percent used in the EIA computations; combines the "resale inflation adjusted rate percent" and the "resale value-percent of sell";

=Resale Value % + (1 + Average Past Inflation Rate)^N, where N="ownership years".

Return on equity:

Same as return on investment; example: if the equipment owner has \$20,000 invested (equity) in the equipment at the present time and a 20% "return on equity" is desired, a net profit before taxes of \$4000 would be necessary;

Return on Equity = $\text{Net Profit Before Taxes} \div \text{Net Worth}$; recommended return on investment of 20% to 40% before income taxes; if less than this rate of return is realized, then the risk is considered not worthwhile (Jackson and Gilliam p. 62 and ch. 4).

Revenue per unit of production:

This is the market price received for the product; example: \$/LCY, \$/BCY.

Selling price:

-(selling price of the machine + sales taxes + transportation to the site - tire cost) Since tires are considered a wear item they should be omitted from the selling price (CPH); there is a differing of opinion as to whether tires should be included in the capital cost.

Simple interest rate:

The finance rate from the lending institution; used in the computation of interest payments; "interest usually paid to the lender as soon as it is earned"; for a principal of \$1000 and a "simple interest rate" of 10% per year nominal, the interest income or expense per year would be \$100 (Collier and Ledbetter p.7); the EIA program uses an amortized schedule with the interest payments calculated by considering the decreasing principal on a monthly basis.

Special items:

These include all costs for high-wear items such as cutting edges, ripper tips, bucket teeth, body liners, router bits, welding of booms and sticks, ground engaging tools, and other similar items (CPH p. 524).

Tax cost of capital:

In the EIA program, this item is calculated from the following formula:

$-(\text{Debt-to-Equity}) \times (\text{Cost of Debt}) \times (1 - \text{TaxRate}) + (1 - \text{Debt-to-Equity}) \times (\text{Return on Equity})$; this formula exists in two parts: the cost of debt and the cost of equity; in the EIA program, the capability to enter a rate of opportunity in the place of calculating the "tax cost of capital" is provided but not in the Macintosh version; it is the rate at which future cash flow values are discounted back to equivalent present values; the treatment of the time-value or devalue of money was not included in CPH and it was published in October of 1985; it is apparent that this concept is being slowly introduced to construction contractors and equipment dealers.

Tax savings:

The difference between the taxes paid without deductions and the taxes paid with deductions; results from the capability of deducting allowable business expenses from the organization's gross taxable income; if not considered, could make the equipment investment not worthwhile.

Taxable income:

The total revenue generated minus the operating expenses.

Tire replacement cost:

An hourly tire cost; $= \text{Tire Set Replacement Cost} \div \text{Total Operating Hours}$.

Trade-in allowance:

Generally, will be determined by the fair market value of the old

equipment; it is the amount deducted from the new selling price allowed toward the purchase of the equipment; if a dealer is involved, then this value will usually be the wholesale book value of the old equipment.

Undercarriage factors:

Factors that account for costs not included in the operating costs' computations; consists of three primary conditions which are handled by Caterpillar as efficiency factors applied to a basic hourly undercarriage cost; the factors are impact (I), abrasiveness (A), and combined (Z); impact is primarily related to the structural effects caused by "bending, chipping, cracking, spalling, roll-over, and pin & bushing retention": correlates high, medium, and low rating factors with the penetration hardness of the surface combined with sizes of bumps in the soil (CPH p. 512); abrasiveness is "the tendency of the underfoot materials to grind away the wear surfaces of track components": high, medium, and low rating factors with the soil's water saturation combined with the shape of particles in the soil (CPH p. 513); the "Z" factor is a catch-all efficiency factor that has the following weighted application: maintenance program equals 50%, terrain equals 30%, operator practices equal 20%; the selection of the appropriate "Z" factor is primarily based upon experience (CPH p.513); the "basic undercarriage factor is a cost per hour determined through the use of a chart of costs versus equipment type (CPH p. 514); once the "basic u/c factor" is determined, the "I", "A", and "Z" factors are summed and multiplied by it to determine the total undercarriage cost per hour; Undercarriage costs can be a major portion of the operating costs, particularly for track-type machines (CPH pp. 512-514).

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APPENDIX A MACINTOSH PROGRAM

A.1 Cell Name Listing

Program line item	Cell name	
Background Data		
Manufacturer.....	MAN	1&2
Model.....	MOD	1&2
Income Tax Rate %.....	PRC_ITR	
Investment Tax Credit %.....	PRC_ITC	1&2
Investment Tax Credit Factor %.....	PRC_ITCF	
Resale Tax Rate %.....	PRC_RTR	
Insurance & Local Tax %.....	PRC_ILTX	
Resale Inflation Adjusted Rate %.....	PRC_RIAR	
Revenue per Unit of Production.....	PROREV	
Production Measured In.....	UQ	
Ownership Data		
Ownership Period (Yrs).....	OWNPER	1&2
% Depreciation in Period.....	PRC_DEP	1&2
Selling Price.....	SP	1&2
Down Payment %.....	PRC_DP	1&2
Trade-In Allowance.....	TIA	1&2
Book Value of Trade.....	BVT	1&2
Finance Period (Mos.).....	FIN_PER	1&2
Simple Interest Rate %.....	PRC_FIN	1&2
Resale Value-% of Sell.....	PRC_RV	1&2
-Inflation Adjusted Rate %..	PRC_IAR_RV	1&2
Annual Scheduled Hours.....	ASHR	1&2
Availability %.....	PRC_AVAIL	1&2
Hourly Production.....	PRO_RATE	1&2
Fuel Use Measured In.....	F_UQ	
Fuel Cost per Unit Volume.....	FCOST	
Operator Salary.....	OSAL	
Fuel Consumed per Hour.....	FCONS	1&2
Oils, Filters, Grease.....	EXP	1&2
Estimated Tire Life.....	TLIFE	1&2
Tire Replacement Cost.....	TCOST	1&2

APPENDIX A (Continued)

Operating Cost Data

Undercarriage: "I" Factor.....	IMP_F	1&2
"A" Factor.....	ABR_F	1&2
"Z" Factor.....	ZEE_F	1&2
Basic U/C Factor.....	UCF	1&2
Repairs: Extended Life Multiplier.....	ELM	1&2
Basic Repair Factor.....	BRF	1&2
Special Items (GET, etc).....	SPEC	1&2
Optional Total Cost/Hour.....	OPT_TOT	1&2

Discounted Cash Flow Data

Debt % of Assets.....	PRC_D2E	
Cost of Debt %.....	PRC_CD	
Return On Equity %.....	PRC_ROE	
Availability-1st Year %.....	PRC_YR1AV	1&2
-Last Year %.....	PRC_YRNAV	1&2
Estimated Inflation %.....	PRC_INFL	
Depreciation %-Year 1.....	PRC_YR1DEP	
-Year 2.....	PRC_YR2DEP	
-Year 3.....	PRC_YR3DEP	
-Year 4.....	PRC_YR4DEP	
-Year 5.....	PRC_YR5DEP	
-Year 6.....	PRC_YR6DEP	
-Year 7.....	PRC_YR7DEP	

APPENDIX A (Continued)

Owning Expense Comparison

Total Cash Payment

+ Interest Payments.....	INT	1&2
+ Insur. & Local Tax.....	ILTX	1&2
 _ =Total Cash Paid Out.....	Cash	1&2

Total Tax Savings

Tax Credit.....	ITC	1&2
+ Interest Payments.....	INT_SAV	1&2
+ Depreciation.....	DEP_SAV	1&2
+ Insur. & Local Tax.....	ILTX_SAV	1&2
 _ =Total Tax Savings.....	TaxSave	1&2

Net Resale After Taxes

_ =Net Resale Income.....	Resale	1&2
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Total Owning Cost

_ =Total Owning Cost After Tax.....	OWN_TOT	1&2
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Operating Expense Comparison

_ =Annual Operating Hours.....	AOHR	1&2
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Hourly Operating Cost

_ =Hourly Fuel Cost.....	Fuel	1&2
 Oils, Filters, Grease.....	OilGrease	1&2
_ =Hourly Tire Cost.....	Tires	1&2
_ =Undercarriage Cost.....	Undercarriage	1&2
_ =Hourly Repair Cost.....	Repair	1&2
 Special Items.....	Special	1&2
 Operator Cost.....	Operator	1&2
 Total Oper. Cost/Hour.....	HrlyOperCost	1&2

Operating Expense Summary

_ =Total Oper. Expense.....	OP_TOT	1&2
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APPENDIX A (Continued)

Revenue & Profit Potential

_Annual Production.....	YRLY_PROD	1&2
_Annual Revenue.....	YRLY_REV	1&2
_Total Rev. Potential.....	REV_TOT	1&2

Profitability Summary

_Taxable Income.....	BTAX_INC	1&2
-Income Tax Payable.....	FIT	1&2
_Net A.Tax Income.....	ATAX_INC	1&2
-Machine Owning Cost.....		
_Net Profit Potential.....	PROFIT	1&2

Cost/Unit of Production

Total Production.....	PROD_TOT	1&2
Total A.Tax Cost/Unit.....	UNIT_COST	1&2

Cost/Operating Hour

Total Operating Hours.....	HRS_TOT	1&2
Total A.Tax Cost/Hour.....	HRLY_COST	1&2
Total A.Tax Production Cost.....	PROD_COST	1&2

Discounted Cash Flow Analysis

A.Tax Cost of Capital.....	PRC_CAPCOST		
_ Discounted Cash Flow.....	PV_1YR	1&2	Cash Flow Year 1
_ Discounted Cash Flow.....	PV_2YR	1&2	Cash Flow Year 2
_ Discounted Cash Flow.....	PV_3YR	1&2	Cash Flow Year 3
_ Discounted Cash Flow.....	PV_4YR	1&2	Cash Flow Year 4
_ Discounted Cash Flow.....	PV_5YR	1&2	Cash Flow Year 5
_ Discounted Cash Flow.....	PV_6YR	1&2	Cash Flow Year 6
_ Discounted Cash Flow.....	PV_7YR	1&2	Cash Flow Year 7

APPENDIX A (Continued)

A.2 Program Formula Listing

Program Line Item

Formula

Background Data

Manufacturer.....
 Model.....
 Income Tax Rate %.....
 Investment Tax Credit %.....
 Investment Tax Credit Factor %.....
 Resale Tax Rate %.....
 Insurance & Local Tax %.....
 Resale Inflation Adjusted Rate %.....
 Revenue per Unit of Production.....
 Production Measured In.....

Ownership Data

Ownership Period (Yrs).....
 % Depreciation in Period.....
 Selling Price.....
 Down Payment %.....
 Trade-In Allowance.....
 Book Value of Trade.....
 Finance Period (Mos.).....
 Simple Interest Rate %.....
 Resale Value-% of Sell.....
 -Inflation Adjusted Rate % $\text{ROUND}(\text{PRC_RV1}/(1+\text{PRC_RIAR}^*0.01)^{\text{OWNPER1,0}})$
 Annual Scheduled Hours.....
 Availability %.....
 Hourly Production.....
 Fuel Use Measured In.....
 Fuel Cost per Unit Volume.....
 Operator Salary.....
 Fuel Consumed per Hour.....
 Oils, Filters, Grease.....
 Estimated Tire Life.....
 Tire Replacement Cost.....

APPENDIX A (Continued)

Operating Cost Data

Undercarriage: "I" Factor.....
 "A" Factor.....
 "Z" Factor.....
 Basic U/C Factor.....
Repairs: Extended Life Multiplier.....
 Basic Repair Factor.....
Special Items (GET, etc).....
Optional Total Cost/Hour.....

Discounted Cash Flow Data

Debt % of Assets.....
Cost of Debt %.....
Return On Equity %.....
Availability-1st Year %.....
 -Last Year %.....
Estimated Inflation %.....
Depreciation %-Year 1.....
 -Year 2.....
 -Year 3.....
 -Year 4.....
 -Year 5.....
 -Year 6.....
 -Year 7.....

APPENDIX A (Continued)

Owning Expense Comparison

	MAN1
	MOD1
Selling Price.....	SP1
Down Payment.....	$0.01 * PRC_DP1 * SP1$
Trade-in Allowance.....	TIA1
Book Value of Trade-in.....	BVT1
Ownership Period.....	OWNPER1
Infl. Adjusted Resale %.....	$PRC_RV1 / (1 + PRC_RIAR * 0.01) ^ OWNPER1$
Finance Period (Mos.).....	FIN_PER1
Simple Interest Rate.....	PRC_FIN1
Insur. & Local Tax %.....	PRC_ILTX
Depreciation %.....	PRC_DEP1
Tax Rate %.....	PRC_ITR
Invest. Tax Credit %.....	PRC_ITC1
% Tax on Resale.....	PRC_RTR
Total Cash Payment	
Selling Price.....	SP1
+ Interest Payments.....	$-PMT(0.01 * PRC_FIN1 / 12, FIN_PER1, SP1 - DOWN1 - TIA1, ..) * FIN_PER1 - (SP1 - DOWN1 - TIA1)$
+ Insur. & Local Tax.....	$((SP1 * (OWNPER1 + 1) + (SP1 * PRC_IAR_RV1 * 0.01) * (OWNPER1 - 1)) / (2 * OWNPER1)) * OWNPER1 * 0.01 * PRC_ILTX$
=Total Cash Paid Out.....	$SP1 + INT1 + ILTX1$
Total Tax Savings	
Tax Credit.....	$(SP1 - TIA1 + BVT1) * PRC_ITC1 * 0.01$
+ Interest Payments.....	$0.01 * PRC_ITR * TOTINT1$
+ Depreciation.....	$IF(OR(TIA1=0, TIA1=""), SP1 - (ITC1 * 0.01 * PRC_ITCF), ((SP1 - TIA1 + BVT1) - (ITC1 * PRC_ITCF * 0.01)) * PRC_DEP1 * 0.01 * PRC_ITR * 0.01)$
+ Insur. & Local Tax.....	$PRC_ITR * 0.01 * ILTX1$
=Total Tax Savings.....	$ITC1 + INT_SAV1 + DEP_SAV1 + ILTX_SAV1$
Net Resale After Taxes	
Est. Market Value.....	$PRC_IAR_RV1 * 0.01 * SP1$
-Book Value.....	$(100 - PRC_DEP1) * 0.01 * (SP1 - TIA1 + BVT1)$
=Additional Income.....	B141-B142
-Taxes Payable.....	$IF(OR(PRC_RTR=0, PRC_RTR=""), PRC_ITR * 0.01 * B143, PRC_RTR * 0.01 * B143)$
=Net Resale Income.....	B141-B144
Total Owning Cost	
Total Cash Payment.....	B128
-Total Tax Savings.....	B137
-Net Resale Income.....	B146
=Total Owning Cost After Tax.....	B157-B158-B159

APPENDIX A (Continued)

Operating Expense Comparison

	MAN1
	MOD1
Annual Scheduled Hours.....	ASHR1
* Availability.....	PRC_AVAIL1
_Annual Operating Hours.....	ASHR1*PRC_AVAIL1*0.01

Hourly Operating Cost

Fuel Consumed/Hour.....	FCONS1
* Price per Unit Vol.....	FCOST
_Hourly Fuel Cost.....	FCONS1*FCOST

Oils, Filters, Grease..... EXP1

Estimated Tire Life.....	TLIFE1
* Replacement Cost.....	TCOST1
_Hourly Tire Cost.....	IF(OR(B217=0,B217="",B218=0,B218=""),0, TCOST1/TLIFE1)

"I" Factor.....	IMP_F1
+ "A" Factor.....	ABR_F1
+ "Z" Factor.....	ZEE_F1
* Basic Factor.....	UCF1
_Undercarriage Cost.....	IF((IMP_F1+ABR_F1+ZEE_F1)=0,UCF1, (IMP_F1+ABR_F1+ZEE_F1)*UCF1)

Ext. Life Multiplier.....	ELM1
* Basic Factor.....	BRF1
_Hourly Repair Cost.....	ELM1*BRF1

Special Items..... SPEC1

Operator Cost..... OSAL

Total Oper. Cost/Hour.....	IF(OPT_TOT1<>"",OPT_TOT1,Fuel1+OilGrease1+Tires1+ Undercarriage1+Repair1+Special1+Operator1)
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Operating Expense Summary

Annual Oper. Hours.....	AOHR1
* Hourly Oper. Cost.....	HrlyOperCost1

_Annual Oper. Cost.....	B239*B240
* Ownership Period.....	OWNPER1

_Total Oper. Expense.....	B242*B243
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APPENDIX A (Continued)

Revenue & Profit Potential

	MAN1
	MOD1
Hourly Production.....	PRO_RATE1
* Annual Operating Hours.....	AOHR1
 _Annual Production.....	 PRO_RATE1*AOHR1
* Unit Price.....	PROREV
 _Annual Revenue.....	 YRLY_PROD1*PROREV
* Ownership Period.....	OWNPER1
 _Total Rev. Potential.....	 YRLY_REV1*OWNPER1

Profitability Summary

Total Rev. Potential.....	REV_TOT1
-Total Oper. Expense.....	OP_TOT1
 _Taxable Income.....	 REV_TOT1-OP_TOT1
-Income Tax Payable.....	BTAX_INC1*PRC_ITR*0.01
 _Net A.Tax Income.....	 BTAX_INC1-FIT1
-Machine Owning Cost.....	OWN_TOT1
 _Net Profit Potential.....	 ATAX_INC1-OWN_TOT1

Cost/Unit of Production

Total Production.....	YRLY_PROD1*OWNPER1
Total Operating Expense.....	OP_TOT1
Before Tax Oper./Unit.....	OP_TOT1/PROD_TOT1
 After Tax Oper./Unit.....	 B283*(1-PRC_ITR*0.01)
After Tax Owning/Unit.....	OWN_TOT1/PROD_TOT1
 Total A.Tax Cost/Unit.....	 B285+B286

Cost/Operating Hour

Total Operating Hours.....	AOHR1*OWNPER1
Total Oper. Expense.....	OP_TOT1
Before Tax Oper./Hour.....	OP_TOT1/HRS_TOT1
 After Tax Oper./Hour.....	 B306*(1-PRC_ITR*0.01)
After Tax Owning/Hour.....	OWN_TOT1/HRS_TOT1
 Total A.Tax Cost/Hour.....	 B308+B309
Total A.Tax Production Cost.....	B311*HRS_TOT1

APPENDIX A (Continued)

Discounted Cash Flow Analysis

	MAN1
	MOD1
Debt % of Assets.....	PRC_D2E
Cost of Debt %.....	PRC_CD
Return On Equity %.....	PRC_ROE
Availability-1st Year %.....	PRC_YR1AV1
-Last Year %.....	PRC_YRNAV1
Estimated Inflation %.....	PRC_INFL
Depreciation %-Year 1.....	PRC_YR1DEP
-Year 2.....	PRC_YR2DEP
-Year 3.....	PRC_YR3DEP
-Year 4.....	PRC_YR4DEP
-Year 5.....	PRC_YR5DEP
-Year 6.....	PRC_YR6DEP
-Year 7.....	PRC_YR7DEP
A.Tax Cost of Capital.....	$PRC_D2E * 0.01 * PRC_CD * 0.01 * (1 - PRC_ITR * 0.01) +$ $(1 - PRC_D2E * 0.01) * PRC_ROE * 0.01$

Cash Flow Year 1

Scheduled Hours.....	ASHR1
* % Mechanical Availability.....	PRC_YR1AV1
_ = Operating Hours.....	$ASHR1 * PRC_YR1AV1 * 0.01$
* Hourly Production.....	PRO_RATE1
_ = Total Production.....	$B372 * B373$
Revenue.....	$B375 * PROREV * (1 + PRC_INFL * 0.01)$
+ Tax Credit.....	ITC1
- Operating Cost.....	$(1 + PRC_INFL * 0.01) * B372 * HrlyOperCost1$
- Depreciation.....	$(SP1 - TIA1 + BVT1 - (ITC1 * PRC_ITCF * 0.01)) * PRC_YR1DEP * 0.01$
- Insurance & Local Taxes.....	$SP1 * (1 + PRC_INFL * 0.01) * 1 * PRC_ILTX * 0.01$
_ = Gross Profit.....	$B377 + B378 - B379 - B380 - B381$
- Income Tax Payable.....	$B383 * PRC_ITR * 0.01$
_ = Net Profit.....	$B383 - B384$
+ Depreciation.....	B380
_ = Net Cash Flow.....	$IF(E368 > OWNPER1, 0, B386 + B387)$
* Discount Factor.....	$1 / (1 + PRC_CAPCOST)^1$
_ = Discounted Cash Flow.....	$B389 * B390$

APPENDIX A (Continued)

Discounted Cash Flow Analysis

Cash Flow Year 2

	MAN1
	MOD1
Scheduled Hours.....	ASHR1
* % Mechanical Availability.....	PRC_YR1AV1-1*((PRC_YR1AV1-PRC_YRNAV1)/ (OWNPER1-1))
_ = Operating Hours.....	ASHR1*B403*0.01
* Hourly Production.....	PRO_RATE1
_ = Total Production.....	B405*B406
Revenue.....	B408*PROREV*(1+PRC_INFL*0.01)^2
- Operating Cost.....	(1+PRC_INFL*0.01)^2*B405*HrlyOperCost1
- Depreciation.....	(SP1-TIA1+BVT1-(ITC1*PRC_ITCF*0.01))* PRC_YR2DEP*0.01
- Insurance & Local Taxes.....	(SP1-SP1*1*(1-PRC_IAR_RV1*0.01)/OWNPER1)* (1+PRC_INFL*0.01)^2*PRC_ILTX*0.01
_ = Gross Profit.....	B410-B411-B412-B413
- Income Tax Payable.....	B415*PRC_ITR*0.01
+ Resale Value.....	IF(E399=OWNPER1,SP1*PRC_IAR_RV1*0.01* (1+PRC_INFL*0.01)^E399,0)
- Book Value.....	IF(E399=OWNPER1,(SP1-TIA1+BVT1-(ITC1*PRC_ITCF* 0.01))*(1-(PRC_YR1DEP*0.01+PRC_YR2DEP*0.01)),0)
- Tax on Resale Income.....	IF(AND(E399=OWNPER1,PRC_RTR=""),PRC_ITR*0.01* (B417-B418),IF(AND(E399=OWNPER1,PRC_RTR<>""), PRC_RTR*0.01*(B417-B418),0))
_ = Net Profit.....	B415-B416+B417-B418-B419
+ Depreciation.....	B412
+ Book Value.....	B418
_ = Net Cash Flow.....	IF(E399>OWNPER1,0,B421+B422+B423)
* Discount Factor.....	1/(1+PRC_CAPCOST)^2
_ = Discounted Cash Flow.....	B425*B426

APPENDIX A (Continued)

Discounted Cash Flow Analysis

Cash Flow Year 3

	MAN1
	MOD1
Scheduled Hours.....	ASHR1
* % Mechanical Availability.....	PRC_YR1AV1-2*((PRC_YR1AV1-PRC_YRNAV1)/ (OWNPER1-1))
_ = Operating Hours.....	ASHR1*B452*0.01
* Hourly Production.....	PRO_RATE1
_ = Total Production.....	B454*B455
Revenue.....	B457*PROREV*(1+PRC_INFL*0.01)^3
- Operating Cost.....	(1+PRC_INFL*0.01)^3*B454*HrlyOperCost1
- Depreciation.....	(SP1-TIA1+BVT1-(ITC1*PRC_ITCF*0.01))* PRC_YR3DEP*0.01
- Insurance & Local Taxes.....	(SP1-SP1*2*(1-PRC_IAR_RV1*0.01)/OWNPER1)* (1+PRC_INFL*0.01)^3*PRC_ILTX*0.01
_ = Gross Profit.....	B459-B460-B461-B462
- Income Tax Payable.....	B464*PRC_ITR*0.01
+ Resale Value.....	IF(E448=OWNPER1,SP1*PRC_IAR_RV1*0.01* (1+PRC_INFL*0.01)^3,0)
- Book Value.....	IF(E448=OWNPER1,(SP1-TIA1+BVT1-(ITC1*PRC_ITCF* 0.01))*(1-(PRC_YR1DEP*0.01+PRC_YR2DEP*0.01+ PRC_YR3DEP*0.01)),0)
- Tax on Resale Income.....	IF(AND(E448=OWNPER1,PRC_RTR=""),PRC_ITR*0.01* (B466-B467),IF(AND(E448=OWNPER1,PRC_RTR<>""), PRC_RTR*0.01*(B466-B467),0))
_ = Net Profit.....	B464-B465+B466-B467-B468
+ Depreciation.....	B461
+ Book Value.....	B467
_ = Net Cash Flow.....	IF(E448>OWNPER1,0,B470+B471+B472)
* Discount Factor.....	1/(1+PRC_CAPCOST)^3
_ = Discounted Cash Flow.....	B474*B475

APPENDIX A (Continued)

Discounted Cash Flow Analysis

Cash Flow Year 4

	MAN1
	MOD1
Scheduled Hours.....	ASHR1
* % Mechanical Availability.....	PRC_YR1AV1-3*((PRC_YR1AV1-PRC_YRNAV1)/ (OWNPER1-1))
_ = Operating Hours.....	ASHR1*B501*0.01
* Hourly Production.....	PRO_RATE1
_ = Total Production.....	B503*B504
Revenue.....	B506*PROREV*(1+PRC_INFL*0.01)^4
- Operating Cost.....	(1+PRC_INFL*0.01)^4*B503*HrlyOperCost1
- Depreciation.....	(SP1-TIA1+BVT1-(ITC1*PRC_ITCF*0.01))* PRC_YR4DEP*0.01
- Insurance & Local Taxes.....	(SP1-SP1*3*(1-PRC_IAR_RV1*0.01)/OWNPER1)* (1+PRC_INFL*0.01)^4*PRC_ILTX*0.01
_ = Gross Profit.....	B508-B509-B510-B511
- Income Tax Payable.....	B513*PRC_ITR*0.01
+ Resale Value.....	IF(E497=OWNPER1,SP1*PRC_IAR_RV1*0.01* (1+PRC_INFL*0.01)^4,0)
- Book Value.....	IF(E497=OWNPER1,(SP1-TIA1+BVT1-(ITC1*PRC_ITCF* 0.01))*(1-(PRC_YR1DEP*0.01+PRC_YR2DEP*0.01+ PRC_YR3DEP*0.01+PRC_YR4DEP*0.01)),0)
- Tax on Resale Income.....	IF(AND(E497=OWNPER1,PRC_RTR=""),PRC_ITR*0.01* (B515-B516),IF(AND(E497=OWNPER1,PRC_RTR<>""), PRC_RTR*0.01*(B515-B516),0))
_ = Net Profit.....	B513-B514+B515-B516-B517
+ Depreciation.....	B510
+ Book Value.....	B516
_ = Net Cash Flow.....	IF(E497>OWNPER1,0,B519+B520+B521)
* Discount Factor.....	1/(1+PRC_CAPCOST)^4
_ = Discounted Cash Flow.....	B523*B524

APPENDIX A (Continued)

Discounted Cash Flow Analysis

Cash Flow Year 5

	MAN1
	MOD1
Scheduled Hours.....	ASHR1
* % Mechanical Availability.....	PRC_YR1AV1-4*((PRC_YR1AV1-PRC_YRNAV1)/ (OWNPER1-1))
_ = Operating Hours.....	ASHR1*B550*0.01
* Hourly Production.....	PRO_RATE1
_ = Total Production.....	B552*B553
Revenue.....	B555*PROREV*(1+PRC_INFL*0.01)^5
- Operating Cost.....	(1+PRC_INFL*0.01)^5*B552*HrlyOperCost1
- Depreciation.....	(SP1-TIA1+BVT1-(ITC1*PRC_ITCF*0.01))* PRC_YR5DEP*0.01
- Insurance & Local Taxes.....	(SP1-SP1*4*(1-PRC_IAR_RV1*0.01)/OWNPER1)* (1+PRC_INFL*0.01)^5*PRC_ILTX*0.01
_ = Gross Profit.....	B557-B558-B559-B560
- Income Tax Payable.....	B562*PRC_ITR*0.01
+ Resale Value.....	IF(E546=OWNPER1,SP1*PRC_IAR_RV1*0.01* (1+PRC_INFL*0.01)^5,0)
- Book Value.....	IF(E546=OWNPER1,(SP1-TIA1+BVT1-(ITC1*PRC_ITCF* 0.01))*(1-(PRC_YR1DEP*0.01+PRC_YR2DEP*0.01+ PRC_YR3DEP*0.01+PRC_YR4DEP*0.01+ PRC_YR5DEP*0.01)),0)
- Tax on Resale Income.....	IF(AND(E546=OWNPER1,PRC_RTR=""),PRC_ITR*0.01* (B564-B565),IF(AND(E546=OWNPER1,PRC_RTR<>""), PRC_RTR*0.01*(B564-B565),0))
_ = Net Profit.....	B562-B563+B564-B565-B566
+ Depreciation.....	B559
+ Book Value.....	B565
_ = Net Cash Flow.....	IF(E546>OWNPER1,0,B568+B569+B570)
* Discount Factor.....	1/(1+PRC_CAPCOST)^5
_ = Discounted Cash Flow.....	B572*B573

APPENDIX A (Continued)

Discounted Cash Flow Analysis

Cash Flow Year 6

	MAN1
	MOD1
Scheduled Hours.....	ASHR1
* % Mechanical Availability.....	PRC_YR1AV1-5*((PRC_YR1AV1-PRC_YRNAV1)/ (OWNPER1-1))
_ = Operating Hours.....	ASHR1*B599*0.01
* Hourly Production.....	PRO_RATE1
_ = Total Production.....	B601*B602
Revenue.....	B604*PROREV*(1+PRC_INFL*0.01)^6
- Operating Cost.....	(1+PRC_INFL*0.01)^6*B601*HrlyOperCost1
- Depreciation.....	(SP1-TIA1+BVT1-(ITC1*PRC_ITCF*0.01))* PRC_YR6DEP*0.01
- Insurance & Local Taxes.....	(SP1-SP1*5*(1-PRC_IAR_RV1*0.01)/OWNPER1)* (1+PRC_INFL*0.01)^6*PRC_ILTX*0.01
_ = Gross Profit.....	B606-B607-B608-B609
- Income Tax Payable.....	B611*PRC_ITR*0.01
+ Resale Value.....	IF(E595=OWNPER1,SP1*PRC_IAR_RV1*0.01* (1+PRC_INFL*0.01)^6,0)
- Book Value.....	IF(E595=OWNPER1,(SP1-TIA1+BVT1-(ITC1*PRC_ITCF* 0.01))*(1-(PRC_YR1DEP*0.01+PRC_YR2DEP*0.01+ PRC_YR3DEP*0.01+PRC_YR4DEP*0.01+PRC_YR5DEP* 0.01+PRC_YR6DEP*0.01)),0)
- Tax on Resale Income.....	IF(AND(E595=OWNPER1,PRC_RTR=""),PRC_ITR*0.01* (B613-B614),IF(AND(E595=OWNPER1,PRC_RTR<>""), PRC_RTR*0.01*(B613-B614),0))
_ = Net Profit.....	B611-B612+B613-B614-B615
+ Depreciation.....	B608
+ Book Value.....	B614
_ = Net Cash Flow.....	IF(E595>OWNPER1,0,B617+B618+B619)
* Discount Factor.....	1/(1+PRC_CAPCOST)^6
_ = Discounted Cash Flow.....	B621*B622

APPENDIX A (Continued)

Discounted Cash Flow Analysis

Cash Flow Year 7

	MAN1
	MOD1
Scheduled Hours.....	ASHR1
* % Mechanical Availability.....	PRC_YR1AV1-6*((PRC_YR1AV1-PRC_YRNAV1)/ (OWNPER1-1))
= Operating Hours.....	ASHR1*B648*0.01
* Hourly Production.....	PRO_RATE1
= Total Production.....	B650*B651
Revenue.....	B653*PROREV*(1+PRC_INFL*0.01)^7
- Operating Cost.....	(1+PRC_INFL*0.01)^7*B650*HrlyOperCost1
- Depreciation.....	(SP1-TIA1+BVT1-(ITC1*PRC_ITCF*0.01))* PRC_YR7DEP*0.01
- Insurance & Local Taxes.....	IF((SP1-SP1*6*(1-PRC_IAR_RV1*0.01)/OWNPER1)* (1+PRC_INFL*0.01)^7*PRC_ILTX*0.01<0,0, (SP1-SP1*6*(1-PRC_IAR_RV1*0.01)/OWNPER1)* (1+PRC_INFL*0.01)^7*PRC_ILTX*0.01)
= Gross Profit.....	B655-B656-B657-B658
- Income Tax Payable.....	B660*PRC_ITR*0.01
+ Resale Value.....	IF(E644=OWNPER1,SP1*PRC_IAR_RV1*0.01* (1+PRC_INFL*0.01)^7,0)
- Book Value.....	IF(E644=OWNPER1,(SP1-TIA1+BVT1-(ITC1*PRC_ITCF* 0.01))*(1-(PRC_YR1DEP*0.01+PRC_YR2DEP*0.01+ PRC_YR3DEP*0.01+PRC_YR4DEP*0.01+PRC_YR5DEP* 0.01+PRC_YR6DEP*0.01+PRC_YR7DEP*0.01)),0)
- Tax on Resale Income.....	IF(AND(E644=OWNPER1,PRC_RTR=""),PRC_ITR*0.01* (B662-B663),IF(AND(E644=OWNPER1,PRC_RTR<>""), PRC_RTR*0.01*(B662-B663),0))
= Net Profit.....	B660-B661+B662-B663-B664
+ Depreciation.....	B657
+ Book Value.....	B663
= Net Cash Flow.....	IF(E644>OWNPER1,0,B666+B667+B668)
* Discount Factor.....	1/(1+PRC_CAPCOST)^7
= Discounted Cash Flow.....	B670*B671

APPENDIX A (Continued)

EIA Graphics Data

Ownership Costs (K)

Cash	-Cash1/1000
TaxSave	TaxSave1/1000
Resale	Resale1/1000
Total Owning	-OWN_TOT1/1000

After Tax Cost Breakdown (\$)

Fuel	$100 * \text{Fuel1} * \text{AOHR1} * \text{OWNPER1} * (1 - \text{PRC_ITR} * 0.01) /$ PROD_COST1
Tires/UC	$100 * (\text{Tires1} + \text{Undercarriage1}) * \text{AOHR1} * \text{OWNPER1} *$ $(1 - \text{PRC_ITR} * 0.01) / \text{PROD_COST1}$
Maint/Rep	$100 * (\text{Repair1} + \text{OilGrease1}) * \text{AOHR1} * \text{OWNPER1} *$ $(1 - \text{PRC_ITR} * 0.01) / \text{PROD_COST1}$
Special	$100 * \text{Special1} * \text{AOHR1} * \text{OWNPER1} * (1 - \text{PRC_ITR} * 0.01) /$ PROD_COST1
Operator	$100 * \text{Operator1} * \text{AOHR1} * \text{OWNPER1} * (1 - \text{PRC_ITR} * 0.01) /$ PROD_COST1
Ownership	$100 * \text{OWN_TOT1} / \text{PROD_COST1}$

AT Costs/Operating Hour

Fuel	$\text{Fuel1} * (1 - \text{PRC_ITR} * 0.01)$
Tires/UC	$(\text{Tires1} + \text{Undercarriage1}) * (1 - \text{PRC_ITR} * 0.01)$
Maint/Rep	$(\text{Repair1} + \text{OilGrease1}) * (1 - \text{PRC_ITR} * 0.01)$
Special	$\text{Special1} * (1 - \text{PRC_ITR} * 0.01)$
Operator	$\text{Operator1} * (1 - \text{PRC_ITR} * 0.01)$
Ownership	$\text{OWN_TOT1} / (\text{AOHR1} * \text{OWNPER1})$
Total	HRLY_COST1

AT Costs/ Unit of Production

Fuel	$\text{Fuel1} * \text{AOHR1} * (1 - \text{PRC_ITR} * 0.01) / \text{YRLY_PROD1}$
Tires/UC	$(\text{Tires1} + \text{Undercarriage1}) * \text{AOHR1} * (1 - \text{PRC_ITR} * 0.01) /$ YRLY_PROD1
Maint/Rep	$(\text{Repair1} + \text{OilGrease1}) * \text{AOHR1} * (1 - \text{PRC_ITR} * 0.01) /$ YRLY_PROD1
Special	$\text{Special1} * \text{AOHR1} * (1 - \text{PRC_ITR} * 0.01) / \text{YRLY_PROD1}$
Operator	$\text{Operator1} * \text{AOHR1} * (1 - \text{PRC_ITR} * 0.01) / \text{YRLY_PROD1}$
Ownership	$\text{OWN_TOT1} / (\text{YRLY_PROD1} * \text{OWNPER1})$
Total	UNIT_COST1

AT Inc & Exp Summary (\$K)

Revenue	$\text{REV_TOT1} / 1000$
Operation	$-\text{OP_TOT1} * (1 - \text{PRC_ITR} * 0.01) / 1000$
Owning	$-\text{OWN_TOT1} / 1000$
Profit	$\text{PROFIT1} / 1000$

APPENDIX A (Continued)

Discounted C. Flow Analysis (\$K)

Difference

Present Value Year 0	-SP1/1000	IF(C753>D753,C745-D745,D745-C745)
Present Value Year 1	PV_1YR1/1000	IF(C753>D753,C746-D746,D746-C746)
Present Value Year 2	PV_2YR1/1000	IF(C753>D753,C747-D747,D747-C747)
Present Value Year 3	PV_3YR1/1000	IF(C753>D753,C748-D748,D748-C748)
Present Value Year 4	PV_4YR1/1000	IF(C753>D753,C749-D749,D749-C749)
Present Value Year 5	PV_5YR1/1000	IF(C753>D753,C750-D750,D750-C750)
Present Value Year 6	PV_6YR1/1000	IF(C753>D753,C751-D751,D751-C751)
Present Value Year 7	PV_7YR1/1000	IF(C753>D753,C752-D752,D752-C752)
Present Value Total	SUM(C745:C752)	IF(C753>D753,C753-D753,D753-C753)

APPENDIX A (Continued)

A.3 Program Output

Date: 7/8/87

Prepared For: Master's Report

Prepared By: Rick Trummer

Background Data

Manufacturer.....	Caterpillar	Komatsu
Model.....	D9L	D375A-1
Income Tax Rate %.....	46.0	
Investment Tax Credit %.....	10.0	10.0
Investment Tax Credit Factor %.....	50.0	
Resale Tax Rate %.....		
Insurance & Local Tax %.....	2.0	
Resale Inflation Adjusted Rate %.....	8.0	
Revenue per Unit of Production.....	0.50	
Production Measured In.....	LCY	

Ownership Data

Ownership Period (Yrs).....	5	5
% Depreciation in Period.....	100	100
Selling Price.....	500,000	468,000
Down Payment %.....	20	10
Trade-In Allowance.....	30,000	35,000
Book Value of Trade.....	25,000	25,000
Finance Period (Mos.).....	48	48
Simple Interest Rate %.....	12.0	10.0
Resale Value- % of Sell.....	30	20
- Inflation Adjusted Rate %..	20	14
Annual Scheduled Hours.....	2,400	2,400
Availability %.....	90	85
Hourly Production.....	924.0	840.0
Fuel Use Measured In.....	U.S. GAL	
Fuel Cost per Unit Volume.....	1.85	
Operator Salary.....	15.00	
Fuel Consumed per Hour.....	16.9	19.5
Oils, Filters, Grease.....	1.03	1.63
Estimated Tire Life.....		
Tire Replacement Cost.....		

APPENDIX A (Continued)

Date: 7/8/87

Prepared For: Master's Report

Prepared By: Rick Trummer

Operating Cost Data

Undercarriage: "I" Factor.....
"A" Factor.....
"Z" Factor.....
Basic U/C Factor.....	5.33	5.37
Repairs: Extended Life Multiplier.....	1.00	1.00
Basic Repair Factor.....	13.05	16.58
Special Items (GET, etc).....	2.52	2.42
Optional Total Cost/Hour.....

Discounted Cash Flow Data

Debt % of Assets.....	56.0	
Cost of Debt %.....	12.0	
Return On Equity %.....	30.0	
Availability- 1st Year %.....	95.0	90.0
-Last Year %.....	90.0	82.0
Estimated Inflation %.....	6.0	
Depreciation %-Year 1.....	15.0	
-Year 2.....	22.0	
-Year 3.....	21.0	
-Year 4.....	21.0	
-Year 5.....	21.0	
-Year 6.....		
-Year 7.....		

APPENDIX A (Continued)

Date: 7/8/87
Prepared For: Master's Report
Prepared By: Rick Trummer

Owning Expense Comparison

	Caterpillar D9L	Komatsu D375A-1
Selling Price.....	500,000	468,000
Down Payment.....	100,000	46,800
Trade-in Allowance.....	30,000	35,000
Book Value of Trade-in.....	25,000	25,000
Ownership Period.....	5	5
Infl. Adjusted Resale %.....	20	14
Finance Period (Mos.).....	48	48
Simple Interest Rate.....	12	10
Insur. & Local Tax %.....	2	2
Depreciation %.....	100	100
Tax Rate %.....	46	46
Invest. Tax Credit %.....	10	10
% Tax on Resale.....	0	0

Total Cash Payment

Selling Price.....	500,000	468,000
+ Interest Payments.....	97,689	83,961
+ Insur. & Local Tax.....	34,000	30,701
<u>=Total Cash Paid Out.....</u>	<u>631,689</u>	<u>582,662</u>

Total Tax Savings

Tax Credit.....	49,500	45,800
+ Interest Payments.....	44,937	38,622
+ Depreciation.....	216,315	200,146
+ Insur. & Local Tax.....	15,640	14,122
<u>=Total Tax Savings.....</u>	<u>326,392</u>	<u>298,691</u>

Net Resale After Taxes

Est. Market Value.....	100,000	65,520
- Book Value.....	0	0
= Additional Income.....	100,000	65,520
- Taxes Payable.....	46,000	30,139
<u>=Net Resale Income.....</u>	<u>54,000</u>	<u>35,381</u>

APPENDIX A (Continued)

Date: 7/8/87

Prepared For: Master's Report

Prepared By: Rick Trummer

Total Owning Cost		
Total Cash Payment.....	631,689	582,662
--Total Tax Savings.....	326,392	298,691
--Net Resale Income.....	54,000	35,381
--Total Owning Cost After Tax.....	<u>251,297</u>	<u>248,591</u>

APPENDIX A (Continued)

Date: 7/8/87

Prepared For: Master's Report

Prepared By: Rick Trummer

Operating Expense Comparison		
	Caterpillar D9L	Komatsu D375A-1
Annual Scheduled Hours.....	2,400	2,400
* Availability.....	90	85
=Annual Operating Hours.....	2,160	2,040
Hourly Operating Cost		
Fuel Consumed/Hour.....	16.9	19.5
* Price per Unit Vol.....	1.85	1.85
=Hourly Fuel Cost.....	31.27	36.08
Oils, Filters, Grease.....	1.03	1.63
Estimated Tire Life.....	0	0
* Replacement Cost.....	0.00	0.00
=Hourly Tire Cost.....	0.00	0.00
"I" Factor.....	0.00	0.00
+ "A" Factor.....	0.00	0.00
+ "Z" Factor.....	0.00	0.00
* Basic Factor.....	5.33	5.37
=Undercarriage Cost.....	5.33	5.37
Ext. Life Multiplier.....	1.00	1.00
* Basic Factor.....	13.05	16.58
=Hourly Repair Cost.....	13.05	16.58
Special Items.....	2.52	2.42
Operator Cost.....	15.00	15.00
Total Oper. Cost/Hour.....	68.20	77.08
Operating Expense Summary		
Annual Oper. Hours.....	2,160	2,040
* Hourly Oper. Cost.....	68.20	77.08
=Annual Oper. Cost.....	147,301	157,233
* Ownership Period.....	5	5
=Total Oper. Expense.....	736,506	786,165

APPENDIX A (Continued)

Date: 7/8/87

Prepared For: Master's Report

Prepared By: Rick Trummer

Revenue & Profit Potential

	Caterpillar D9L	Komatsu D375A-1
Hourly Production.....	924	840
* Annual Operating Hours.....	2,160	2,040
<u>=Annual Production.....</u>	<u>1,995,840</u>	<u>1,713,600</u>
* Unit Price.....	0.50	0.50
<u>=Annual Revenue.....</u>	<u>997,920</u>	<u>856,800</u>
* Ownership Period.....	5	5
<u>=Total Rev. Potential.....</u>	<u>4,989,600</u>	<u>4,284,000</u>

Profitability Summary

Total Rev. Potential.....	4,989,600	4,284,000
-Total Oper. Expense.....	736,506	786,165
<u>=Taxable Income.....</u>	<u>4,253,094</u>	<u>3,497,835</u>
-Income Tax Payable.....	1,956,423	1,609,004
<u>=Net A. Tax Income.....</u>	<u>2,296,671</u>	<u>1,888,831</u>
-Machine Owning Cost.....	251,297	248,591
<u>=Net Profit Potential.....</u>	<u>2,045,374</u>	<u>1,640,240</u>

Cost/Unit of Production

Total Production.....	9,979,200	8,568,000
Total Operating Expense.....	736,506	786,165
Before Tax Oper./Unit.....	0.074	0.092
After Tax Oper./Unit.....	0.040	0.050
After Tax Owning/Unit.....	0.025	0.029
Total A. Tax Cost/Unit.....	0.065	0.079

APPENDIX A (Continued)

Date: 7/8/87
 Prepared For: Master's Report
 Prepared By: Rick Trummer

Cost/Operating Hour		
Total Operating Hours.....	10,800	10,200
Total Oper. Expense.....	736,506	786,165
Before Tax Oper./Hour.....	<u>68.20</u>	<u>77.08</u>
After Tax Oper./Hour.....	36.83	41.62
After Tax Owning/Hour.....	23.27	24.37
Total A.Tax Cost/Hour.....	<u>60.09</u>	<u>65.99</u>
Total A.Tax Production Cost.....	<u>649,010</u>	<u>673,120</u>

APPENDIX A (Continued)

Date: 7/8/87
Prepared For: Master's Report
Prepared By: Rick Trummer

Discounted Cash Flow Analysis

	Caterpillar D9L	Komatsu D375A-1
Debt % of Assets.....	56.0	56.0
Cost of Debt %.....	12.0	12.0
Return On Equity %.....	30.0	30.0
Availability-1st Year %.....	95.0	90.0
-Last Year %.....	90.0	82.0
Estimated Inflation %.....	6.0	6.0
Depreciation % -Year 1.....	15.0	15.0
-Year 2.....	22.0	22.0
-Year 3.....	21.0	21.0
-Year 4.....	21.0	21.0
-Year 5.....	21.0	21.0
-Year 6.....	0.0	0.0
-Year 7.....	0.0	0.0
A. Tax Cost of Capital.....	0.17	0.17

		Cash Flow Yr 1
Scheduled Hours.....	2,400	2,400
* % Mechanical Availability.....	95.00	90.00
= Operating Hours.....	2,280	2,160
* Hourly Production.....	924	840
= Total Production.....	2,106,720	1,814,400
Revenue.....	1,116,562	961,632
+ Tax Credit.....	49,500	45,800
- Operating Cost.....	164,814	176,471
- Depreciation.....	70,538	65,265
- Insurance & Local Taxes.....	10,600	9,922
= Gross Profit.....	920,110	755,774
- Income Tax Payable.....	423,251	347,656
= Net Profit.....	496,860	408,118
+ Depreciation.....	70,538	65,265
= Net Cash Flow.....	567,397	473,383
* Discount Factor.....	0.86	0.86
= Discounted Cash Flow.....	485,665	405,194

APPENDIX A (Continued)

Date: 7/8/87

Prepared For: Master's Report

Prepared By: Rick Trummer

Discounted Cash Flow Analysis		Cash Flow Yr 2
	Caterpillar D9L	Komatsu D375A-1
Scheduled Hours.....	2,400	2,400
* % Mechanical Availability.....	93.75	88.00
_ = Operating Hours.....	2,250	2,112
* Hourly Production.....	924	840
_ = Total Production.....	2,079,000	1,774,080
Revenue.....	1,167,982	996,678
- Operating Cost.....	172,404	182,902
- Depreciation.....	103,455	95,722
- Insurance & Local Taxes.....	9,438	8,708
_ = Gross Profit.....	882,685	709,346
- Income Tax Payable.....	406,035	326,299
+ Resale Value.....	0	0
- Book Value.....	0	0
- Tax on Resale Income.....	0	0
_ = Net Profit.....	476,650	383,047
+ Depreciation.....	103,455	95,722
+ Book Value.....	0	0
_ = Net Cash Flow.....	580,105	478,769
* Discount Factor.....	0.73	0.73
_ = Discounted Cash Flow.....	425,017	350,773

APPENDIX A (Continued)

Date: 7/8/87

Prepared For: Master's Report

Prepared By: Rick Trummer

Discounted Cash Flow Analysis		Cash Flow Yr 3
	Caterpillar D9L	Komatsu D375A-1
Scheduled Hours.....	2,400	2,400
* % Mechanical Availability.....	92.50	86.00
<u>= Operating Hours.....</u>	<u>2,220</u>	<u>2,064</u>
* Hourly Production.....	924	840
<u>= Total Production.....</u>	<u>2,051,280</u>	<u>1,733,760</u>
Revenue.....	1,221,554	1,032,468
- Operating Cost.....	180,311	189,470
- Depreciation.....	98,753	91,371
- Insurance & Local Taxes.....	8,099	7,313
<u>= Gross Profit.....</u>	<u>934,391</u>	<u>744,314</u>
- Income Tax Payable.....	429,820	342,384
+ Resale Value.....	0	0
- Book Value.....	0	0
- Tax on Resale Income.....	0	0
<u>= Net Profit.....</u>	<u>504,571</u>	<u>401,929</u>
+ Depreciation.....	98,753	91,371
+ Book Value.....	0	0
<u>= Net Cash Flow.....</u>	<u>603,324</u>	<u>493,300</u>
* Discount Factor.....	0.63	0.63
<u>= Discounted Cash Flow.....</u>	<u>378,356</u>	<u>309,358</u>

APPENDIX A (Continued)

Date: 7/8/87

Prepared For: Master's Report

Prepared By: Rick Trummer

Discounted Cash Flow Analysis		Cash Flow Yr 4
	Caterpillar D9L	Komatsu D375A-1
Scheduled Hours.....	2,400	2,400
* % Mechanical Availability.....	91.25	84.00
<u>= Operating Hours.....</u>	<u>2,190</u>	<u>2,016</u>
* Hourly Production.....	924	840
<u>= Total Production.....</u>	<u>2,023,560</u>	<u>1,693,440</u>
Revenue.....	1,277,349	1,068,964
- Operating Cost.....	188,547	196,168
- Depreciation.....	98,753	91,371
- Insurance & Local Taxes.....	6,565	5,719
<u>= Gross Profit.....</u>	<u>983,484</u>	<u>775,706</u>
- Income Tax Payable.....	452,403	356,825
+ Resale Value.....	0	0
- Book Value.....	0	0
- Tax on Resale Income.....	0	0
<u>= Net Profit.....</u>	<u>531,082</u>	<u>418,881</u>
+ Depreciation.....	98,753	91,371
+ Book Value.....	0	0
<u>= Net Cash Flow.....</u>	<u>629,834</u>	<u>510,252</u>
* Discount Factor.....	0.54	0.54
<u>= Discounted Cash Flow.....</u>	<u>338,085</u>	<u>273,896</u>

APPENDIX A (Continued)

Date: 7/8/87

Prepared For: Master's Report

Prepared By: Rick Trummer

Discounted Cash Flow Analysis		Cash Flow Yr 5
	Caterpillar D9L	Komatsu D375A-1
Scheduled Hours.....	2,400	2,400
* % Mechanical Availability.....	90.00	82.00
<u>= Operating Hours.....</u>	<u>2,160</u>	<u>1,968</u>
* Hourly Production.....	924	840
<u>= Total Production.....</u>	<u>1,995,840</u>	<u>1,653,120</u>
Revenue.....	1,335,442	1,106,124
- Operating Cost.....	197,122	202,987
- Depreciation.....	98,753	91,371
- Insurance & Local Taxes.....	4,818	3,908
<u>= Gross Profit.....</u>	<u>1,034,750</u>	<u>807,858</u>
- Income Tax Payable.....	475,985	371,615
+ Resale Value.....	133,823	87,681
- Book Value.....	0	0
- Tax on Resale Income.....	61,558	40,333
<u>= Net Profit.....</u>	<u>631,029</u>	<u>483,591</u>
+ Depreciation.....	98,753	91,371
+ Book Value.....	0	0
<u>= Net Cash Flow.....</u>	<u>729,782</u>	<u>574,962</u>
* Discount Factor.....	0.46	0.46
<u>= Discounted Cash Flow.....</u>	<u>335,308</u>	<u>264,174</u>

APPENDIX A (Continued)

Date: 7/8/87
 Prepared For: Master's Report
 Prepared By: Rick Trummer

Discounted Cash Flow Analysis		Cash Flow Yr 6
	Caterpillar D9L	Komatsu D375A-1
Scheduled Hours.....	2,400	2,400
* % Mechanical Availability.....	88.75	80.00
<u>= Operating Hours.....</u>	<u>2,130</u>	<u>1,920</u>
* Hourly Production.....	924	840
<u>= Total Production.....</u>	<u>1,968,120</u>	<u>1,612,800</u>
Revenue.....	1,395,908	1,143,894
- Operating Cost.....	206,047	209,918
- Depreciation.....	0	0
- Insurance & Local Taxes.....	2,837	1,859
<u>= Gross Profit.....</u>	<u>1,187,023</u>	<u>932,117</u>
- Income Tax Payable.....	546,031	428,774
+ Resale Value.....	0	0
- Book Value.....	0	0
- Tax on Resale Income.....	0	0
<u>= Net Profit.....</u>	<u>640,993</u>	<u>503,343</u>
+ Depreciation.....	0	0
+ Book Value.....	0	0
<u>= Net Cash Flow.....</u>	<u>0</u>	<u>0</u>
* Discount Factor.....	0.39	0.39
<u>= Discounted Cash Flow.....</u>	<u>0</u>	<u>0</u>

APPENDIX A (Continued)

Date: 7/8/87

Prepared For: Master's Report

Prepared By: Rick Trummer

Discounted Cash Flow Analysis		Cash Flow Yr 7
	Caterpillar D9L	Komatsu D375A-1
Scheduled Hours.....	2,400	2,400
* % Mechanical Availability.....	87.50	78.00
<u>= Operating Hours.....</u>	<u>2,100</u>	<u>1,872</u>
* Hourly Production.....	924	840
<u>= Total Production.....</u>	<u>1,940,400</u>	<u>1,572,480</u>
Revenue.....	1,458,822	1,182,214
- Operating Cost.....	215,334	216,950
- Depreciation.....	0	0
- Insurance & Local Taxes.....	601	0
<u>= Gross Profit.....</u>	<u>1,242,886</u>	<u>965,264</u>
- Income Tax Payable.....	571,728	444,021
+ Resale Value.....	0	0
- Book Value.....	0	0
- Tax on Resale Income.....	0	0
<u>= Net Profit.....</u>	<u>671,159</u>	<u>521,242</u>
+ Depreciation.....	0	0
+ Book Value.....	0	0
<u>= Net Cash Flow.....</u>	<u>0</u>	<u>0</u>
* Discount Factor.....	0.34	0.34
<u>= Discounted Cash Flow.....</u>	<u>0</u>	<u>0</u>

APPENDIX A (Continued)

Date: 7/8/87

Prepared For: Master's Report

Prepared By: Rick Trummer

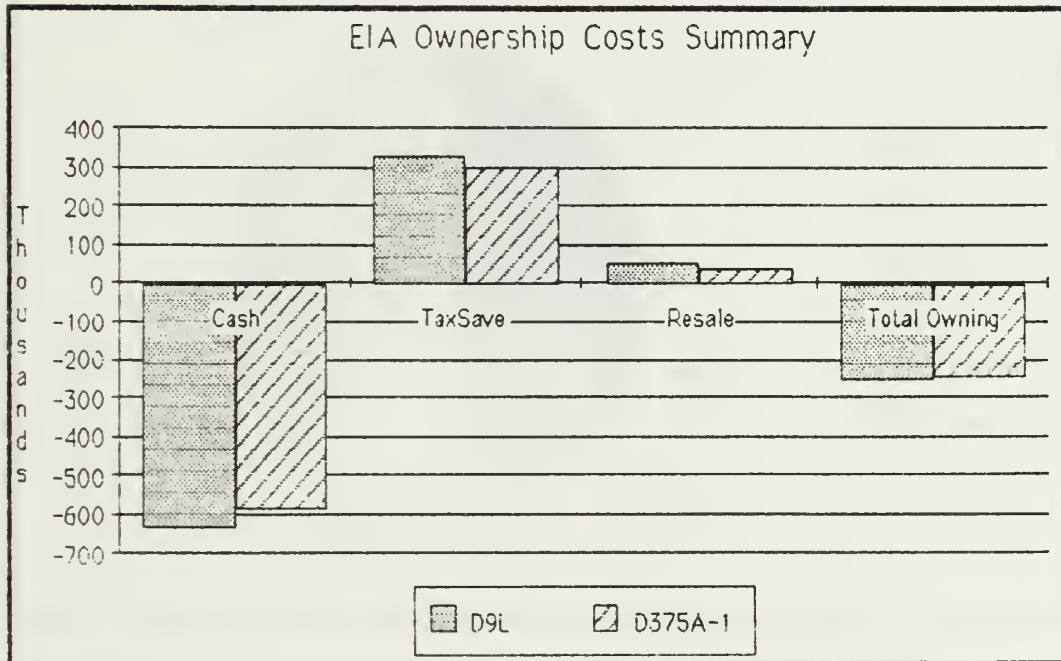
EIA Graphics Data			
Ownership Costs (K)		Caterpillar D9L	Komatsu D375A-1
	Cash	-632	-583
	Tax/Save	326	299
	Resale	54	35
	Total Owning	-251	-249
After Tax Cost Breakdown (%)		Caterpillar D9L	Komatsu D375A-1
	Fuel	28	30
	Tires/UC	5	4
	Maint/Rep	13	15
	Special	2	2
	Operator	13	12
	Ownership	39	37
After Tax Costs/Operating Hour		Caterpillar D9L	Komatsu D375A-1
	Fuel	17	19
	Tires/UC	3	3
	Maint/Rep	8	10
	Special	1	1
	Operator	8	8
	Ownership	23	24
	Total	60	66
After Tax Costs/ Unit of Production		Caterpillar D9L	Komatsu D375A-1
	Fuel	0.018	0.023
	Tires/UC	0.003	0.003
	Maint/Rep	0.008	0.012
	Special	0.001	0.002
	Operator	0.009	0.010
	Ownership	0.025	0.029
	Total	0.065	0.079
After Tax Inc & Exp Summary (\$K)		Caterpillar D9L	Komatsu D375A-1
	Revenue	4,990	4,284
	Operation	-398	-398
	Owning	-251	-249
	Profit	2,045	1,640

APPENDIX A (Continued)

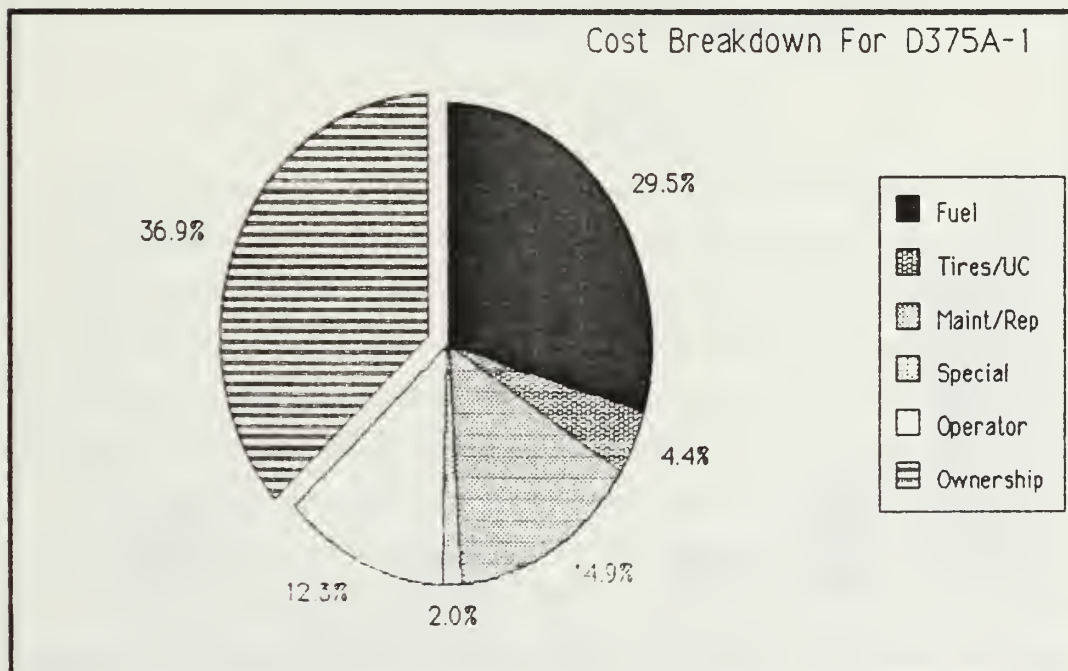
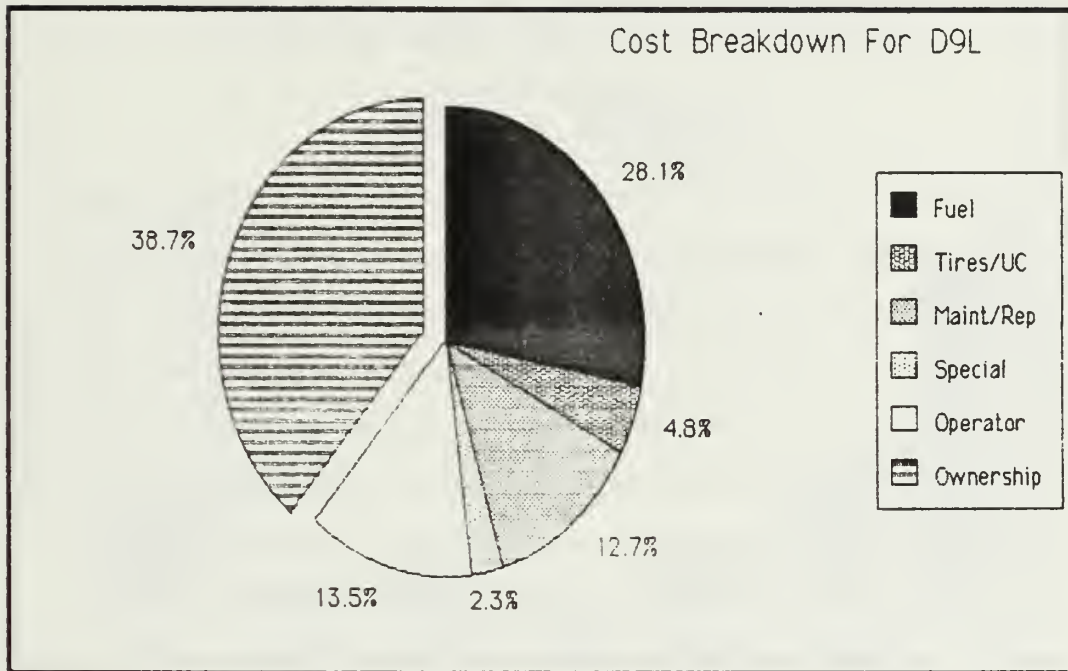
Date: 7/8/87
 Prepared For: Master's Report
 Prepared By: Rick Trummer

Discounted Cash Flow Analysis (\$K)		Caterpillar D9L	Komatsu D375A-1	Difference
Present Value Year	0	-500	-468	-32
Present Value Year	1	486	405	80
Present Value Year	2	425	351	74
Present Value Year	3	378	309	69
Present Value Year	4	338	274	64
Present Value Year	5	335	264	71
Present Value Year	6	0	0	0
Present Value Year	7	0	0	0
Total		1,462.432	1,135	327

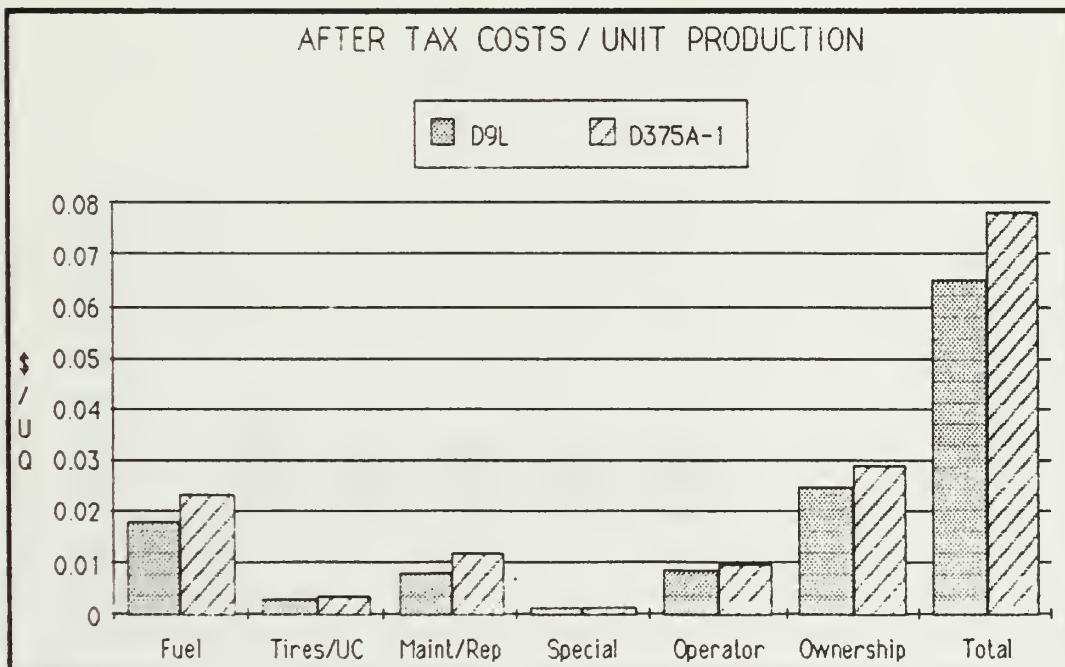
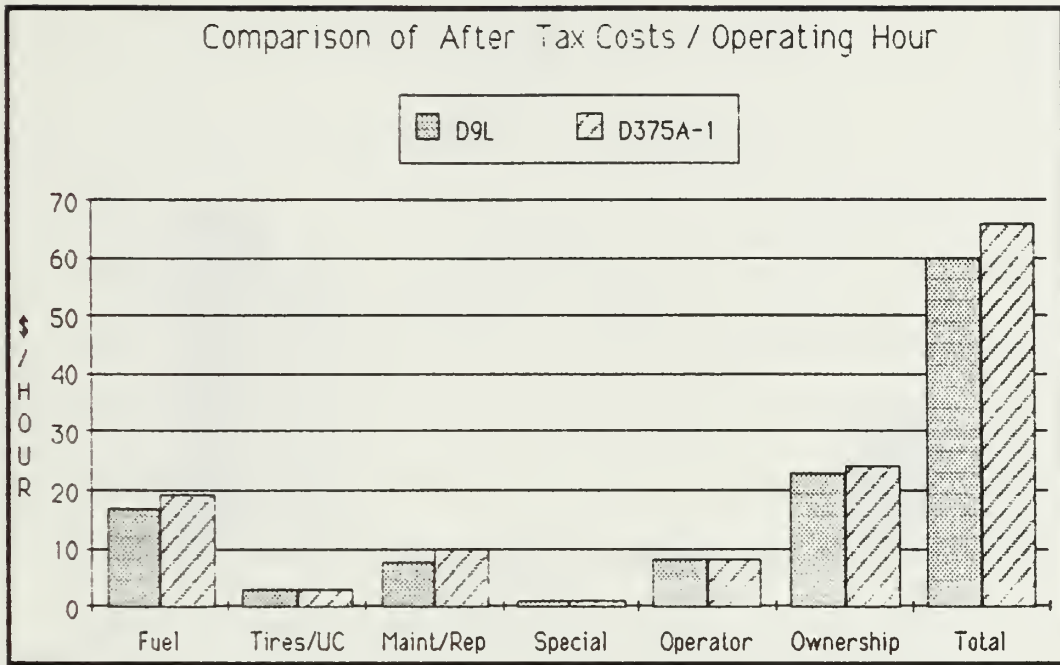
APPENDIX A (Continued)



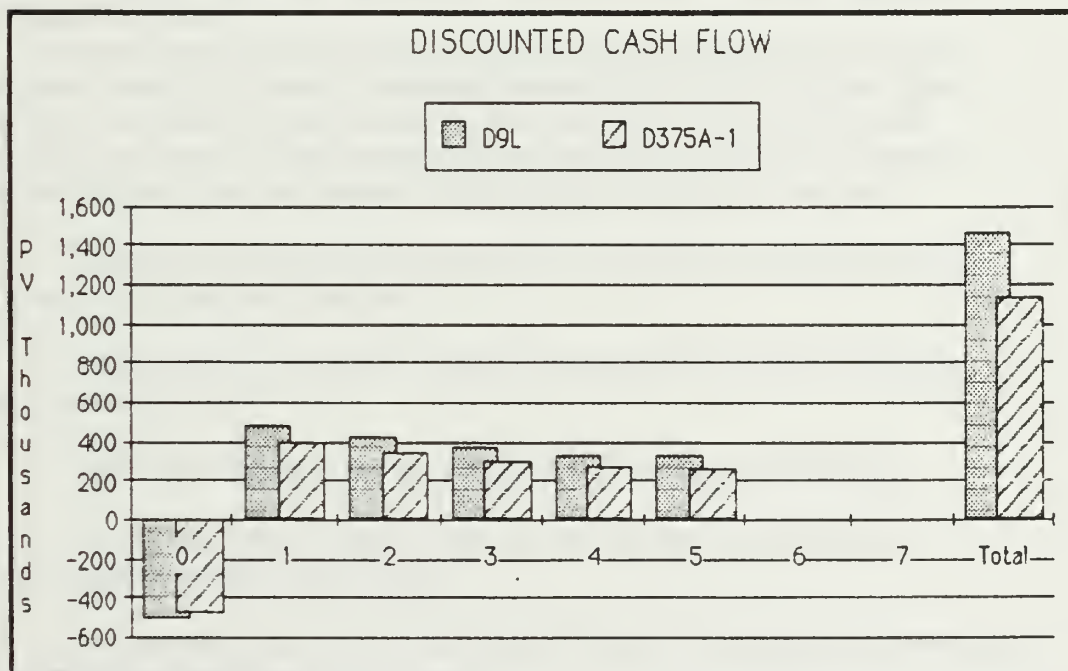
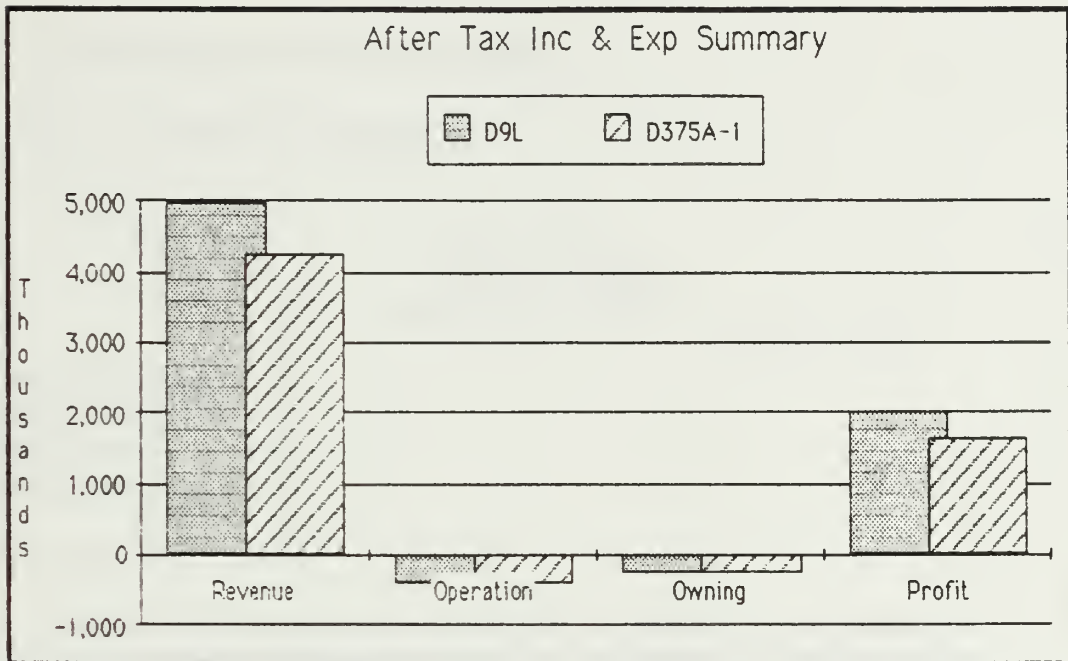
APPENDIX A (Continued)



APPENDIX A (Continued)



APPENDIX A (Continued)



APPENDIX B
CORRESPONDENCE

B.1 Corresponding with Program Author

B.1.1 Letter to EIA Author

F. G. Trummer, Jr.
7108 Sw 75th Street
Gainesville, Fl. 32608

June 25, 1987

Product Sales Support
Caterpillar Tractor Co.
Peoria, Illinois
Attn: Bob Johnson

Dear Mr. Johnson:

I am the graduate student at the University of Florida that wrote the handwritten letter to you a couple of weeks ago. Since that time, I have been able to locate a copy of the documentation that accompanied the software; most of my technical questions are resolved at the moment.

As a side issue to studying the program and related investment issues for heavy equipment, I would like to send out a few questionnaires to users of the program to see if they are in fact **using** it and how successful they have been. I'll trust that you can provide an objective list of dealerships that have been given the program in the recent past and that would provide a response. Some questions I would like to ask are:

1. How many times have you used Caterpillar's Equipment Investment Analysis program (EIA) in the last six months?
2. Do you feel that customers are generally receptive to the type of information output produced by EIA?
3. What contribution(s) has EIA given to you as a business organization?
4. Do you feel that the concepts employed in EIA are easily understood by the majority of your employees and clients?
5. Do your employees and clients understand concepts surrounding production rate influence factors and discounted cash flows?
6. What comments would you like to make regarding the EIA program and would you like your response to be incorporated into a *general* letter addressed to Caterpillar Tractor Company?

APPENDIX B (Continued)

While I may come up with other general questions along the same line of reasoning, you probably get the idea of what I am after. It would be interesting to know what role that investment models play in the dealerships. If you or your fellow workers can think of any questions that you would like responses to, let me know quickly. I would like to get the questionnaire drawn up and mailed out soonest. Thanks.

Sincerely yours,

Rick Trummer

APPENDIX B (Continued)

B.1.2 Phone Conversation Notes

Mr. Bob Johnson, the author of Caterpillar's Equipment Investment III program, contacted me the evening of July 10, 1987. He called in response to my letter, at page B-1, that requested the names and addresses of Caterpillar dealers so that I might send out questionnaires.

We discussed the history of the program and several of the variables used. Mr. Johnson stated that Caterpillar dealers are just beginning to employ personal computers for analyzing investment alternatives. He further stated that the reason for the delay is that internal politics in the dealership organizations has prevented adequate training of the sales force and that management personnel are unfamiliar and unwilling to change their procedures for analysis. He was unable to describe what procedures are being used, if a present-worth comparison or the like, is not in use.

Mr. Johnson went on to state that urban dealers would be more familiar with investment analysis methods due to their larger staffs and thus greater potential for business-oriented personnel with backgrounds in accounting and marketing.

Caterpillar has been developing this equipment investment analysis program for several years and has been using the package, from which I studied, as a training tool for approximately two years. A compiled version of the EIA III program, written in C, and runnable on IBM personal computers is expected to be on the market within months.

Mr. Johnson mentioned that he would promptly mail a list of approximately 20 dealerships in the U.S. that have been exposed to equipment investment methods.

APPENDIX B (Continued)

Peoria, Illinois 61629

B.1.3 Letter From Author

July 11, 1987

Mr. F.G. Trummer, Jr.
7108 SW 75th Street
Gainesville, FL 32608

Dear Rick:

Enjoyed talking with you last night. Attached is a list of the pilot users of our new Equipment Investment Analysis program. When you contact these folks, you are welcome to use my name and Fred Grafton's name as a reference.

Please send me a copy of your questionnaire and the responses you get. I'm always interested in feedback on our program. Also, I'd appreciate it if you would send me a copy of your report and your templates and data files when you're finished with your analysis. My mailing address is:

Dealer Marketing Systems
Caterpillar Inc.
100 N.E. Adams
Peoria, Ill. 61629-5470

Thanks for your interest in our work. I'm looking forward to seeing the results of your project. Good luck.

APPENDIX B (Continued)

Beckwith Machinery Co.
Tom Lampert, Sales Engineer
Mail: P.O. Box 8718
Pittsburgh, Pa.
15221

Darr Equipment Co.
Jerry West, Sales Manager
Mail: P.O. Box 20737
Irving, Texas
75220

Butler Machinery Company
Darryl Galt, Major Accounts
Mail: P.O. Box 757
Bismarck, N.D.
58502

Kearns Machinery Co.
Nathan C. Hobbs, Major Accounts
Mail: P.O. Box 1307
Sioux Falls, S.D.
57101

Carter Machinery Co.
Roger Jetton, Sales Manager
Mail: P.O. Box 1096
Salem, VA.
24153-3096

Gregory Poole Equipment Co.
Ben Bradsher, Sales Manager
Mail: P.O. Box 469,
Raleigh, N.C.
27602

Whayne Supply Company
Edwin Downer, Sales Engineer
Mail: P.O. Box 35900
Louisville, Ky.
40232

Thompson Tractor Co., Inc.
Mike Rooney, Sales Manager
Mail: P.O. Box 10367
Tarrant, Ala.
35202

Holt-Refakis Equipment Company
Fred Gibbs, Financial Mktg.Mgr.
Mail: P.O. Box 27040
Columbus, OH
43227

FABCO Equipment Inc.
Dave Cook
Mail: P.O. Box 19976
Green Bay, WI
54307

Dean Machinery Co.
Bob Thomas, Credit Manager
Mail: P.O. Box 1176
Kansas City, Mo.
64141

Ziegler Inc.
Jim Petersen, Marketing Manager
Mail: 901 W. 94th Street
Bloomington, Mn.
55420

NC Machinery Co.
Gary Norman, VP-Info.Services
Mail: P.O. Box 3562
Tukwila, WA
98124

R.Angus Alberta Ltd.
Jim Irving, Sales Engineer
Mail: P.O. Box 2405
Edmonton, Alta
Canada T5J 2S1

APPENDIX B (Continued)

B.2 Corresponding with Program Author

B.2.1 Cover Letter to Questionnaire

F. G. Trummer, Jr.
7108 SW 75th Street
Gainesville, Florida 32608

Date:

Company
Address
City, State Zip

Dear Point of Contact:

I am a graduate student in Civil Engineering at the University of Florida and am studying Caterpillar's Equipment Investment Analysis methods. I obtained your organization's name and address from a home-office representative of Caterpillar and would be most appreciative if you would take a few moments to complete the questionnaire attached. It has been prepared to take as little of your time as possible.

Please use the self-addressed and stamped envelope provided. Since I have but a few days to collect the responses and tabulate the results, I would ask that you please do not delay in handling the questionnaire. Thank you for participating.

Sincerely yours,

F. G. Trummer, Jr.

APPENDIX B (Continued)

B 2.2 Questionnaire Example

QUESTIONNAIRE

YES NO

1. Does your organization consider "discounted cash flow" when:

☐ ☐ A. Deciding to purchase/lease equipment?

☐ ☐ B. Assisting customers in the purchase/lease of equipment?

*If the answers to both of the above were "No", please go to question #5.

☐ ☐ 2. Does your organization employ personal computers for the analysis of equipment investment alternatives?

*If the answer to the above was "No", please go to question #5.

3. Does your organization use:

☐ ☐ A. Caterpillar's Equipment Investment Analysis program?

☐ ☐ B. A customized or local program?

☐ ☐ C. A commercially available program?

☐ 4. On a scale of 1 to 5 with 5=totally useful, how effective has your computer equipment been in the decision, by your customers, to purchase equipment?

*Please mail this form in the self-addressed and stamped envelope provided.

5. Please comment on why computers or discounted cash flow analyses are not employed in the analysis of equipment investment alternatives.

6. What is your position within the organization?

*Please mail this form in the self-addressed and stamped envelope provided.

B.2.3 Returned Questionnaires **QUESTIONNAIRE**

YES NO

1. Does your organization consider "discounted cash flow" when:

☒ ☐ A. Deciding to purchase/lease equipment?☒ ☐ B. Assisting customers in the purchase/lease of equipment?

*If the answers to both of the above were "No", please go to question #5.

☒ ☐ 2. Does your organization employ personal computers for the analysis of equipment investment alternatives?

*If the answer to the above was "No", please go to question #5.

3. Does your organization use:

☒ ☐ A. Caterpillar's Equipment Investment Analysis program?☒ ☐ B. A customized or local program?☐ ☐ C. A commercially available program?☒ 4. On a scale of 1 to 5 with 5=totally useful, how effective has your computer equipment been in the decision, by your customers, to purchase equipment?

*Please mail this form in the self-addressed and stamped envelope provided.

☐ ☐ 5. Please comment on why computers or discounted cash flow analyses are not employed in the analysis of equipment investment alternatives.

6. What is your position within the organization?

MANAGER- MINE ACCOUNTS

*Please mail this form in the self-addressed and stamped envelope provided.

QUESTIONNAIRE

YES NO

1. Does your organization consider "discounted cash flow" when:

☐ ☒ A. Deciding to purchase/lease equipment?☒ ☐ B. Assisting customers in the purchase/lease of equipment?

*If the answers to both of the above were "No", please go to question #5.

☒ ☐ 2. Does your organization employ personal computers for the analysis of equipment investment alternatives?

*If the answer to the above was "No", please go to question #5.

3. Does your organization use:

☒ ☐ A. Caterpillar's Equipment Investment Analysis program?☐ ☐ B. A customized or local program?☐ ☐ C. A commercially available program?☒ 4. On a scale of 1 to 5 with 5=totally useful, how effective has your computer equipment been in the decision, by your customers, to purchase equipment?

*Please mail this form in the self-addressed and stamped envelope provided.

☐ ☐ 5. Please comment on why computers or discounted cash flow analyses are not employed in the analysis of equipment investment alternatives.

6. What is your position within the organization?

Sales Manager

*Please mail this form in the self-addressed and stamped envelope provided.

QUESTIONNAIRE

YES NO

1. Does your organization consider "discounted cash flow" when:

☐ ☒ A. Deciding to purchase/lease equipment?☒ ☐ B. Assisting customers in the purchase/lease of equipment?

*If the answers to both of the above were "No", please go to question #5.

☒ ☐ 2. Does your organization employ personal computers for the analysis of equipment investment alternatives?

*If the answer to the above was "No", please go to question #5.

3. Does your organization use:

☒ ☐ A. Caterpillar's Equipment Investment Analysis program?☐ ☒ B. A customized or local program?☐ ☒ C. A commercially available program?☐ ☒ 3 4. On a scale of 1 to 5 with 5=totally useful, how effective has your computer equipment been in the decision, by your customers, to purchase equipment?

*Please mail this form in the self-addressed and stamped envelope provided.

☐ ☐ 5. Please comment on why computers or discounted cash flow analyses are not employed in the analysis of equipment investment alternatives.

FINANCIAL EXPERTISE BACKGROUND AND TRAINING IS REQUIRED. WE FIND THAT WE CAN ONLY USE THE EQUIP-INVESTMENT ANALYSIS (AND THE DISCOUNTED CASH FLOW IN PARTICULAR) WITH VERY LARGE COMPANIES OR COAL-MINING ORGANIZATION ⇒ COMPANIES THAT OWN 50 OR MORE MACHINES

6. What is your position within the organization?

SALES ENGINEER (MARKETING, SALES SUPPORT FUNCTIONS)

*Please mail this form in the self-addressed and stamped envelope provided.

QUESTIONNAIRE

YES NO

1. Does your organization consider "discounted cash flow" when:

☒ ☐ A. Deciding to purchase/lease equipment?☒ ☐ B. Assisting customers in the purchase/lease of equipment?

*If the answers to both of the above were "No", please go to question #5.

☒ ☐ 2. Does your organization employ personal computers for the analysis of equipment investment alternatives?

*If the answer to the above was "No", please go to question #5.

3. Does your organization use:

☒ ☐ A. Caterpillar's Equipment Investment Analysis program?☐ ☒ B. A customized or local program?☐ ☒ C. A commercially available program?☐ ☒ 4. On a scale of 1 to 5 with 5=totally useful, how effective has your computer equipment been in the decision, by your customers, to purchase equipment?

*Please mail this form in the self-addressed and stamped envelope provided.

☐ ☐ 5. Please comment on why computers or discounted cash flow analyses are not employed in the analysis of equipment investment alternatives.

6. What is your position within the organization?

TECHNICAL SERVICES SUPERVISOR

*Please mail this form in the self-addressed and stamped envelope provided.

SORRY FOR THE DELAY, I WAS ON VACATION.

QUESTIONNAIRE

YES NO

1. Does your organization consider "discounted cash flow" when:

☒ ☐ A. Deciding to purchase/lease equipment?☒ ☐ B. Assisting customers in the purchase/lease of equipment?

*If the answers to both of the above were "No", please go to question #5.

☒ ☐ 2. Does your organization employ personal computers for the analysis of equipment investment alternatives?

*If the answer to the above was "No", please go to question #5.

3. Does your organization use:

☒ ☐ A. Caterpillar's Equipment Investment Analysis program?☐ ☒ B. A customized or local program?☐ ☒ C. A commercially available program?☐ ☒ 3 4. On a scale of 1 to 5 with 5=totally useful, how effective has your computer equipment been in the decision, by your customers, to purchase equipment?

*Please mail this form in the self-addressed and stamped envelope provided.

☐ ☐ 5. Please comment on why computers or discounted cash flow analyses are not employed in the analysis of equipment investment alternatives.

6. What is your position within the organization?

Credit & Finance Coordinator

*Please mail this form in the self-addressed and stamped envelope provided.

QUESTIONNAIRE

YES NO

1. Does your organization consider discounted cash flow" when:☐ ☒ A. Deciding to purchase/lease equipment?☐ ☒ B. Assisting customers in the purchase/lease of equipment?

*If the answers to both of the above were "No", please go to question #5.

☒ ☐ 2. Does your organization employ personal computers for the analysis of equipment investment alternatives?

*If the answer to the above was "No", please go to question #5.

3. Does your organization use:

☒ ☐ A. Caterpillar's Equipment Investment Analysis program?☒ ☐ B. A customized or local program?☐ ☐ C. A commercially available program?☐ 3 4. On a scale of 1 to 5 with 5=totally useful, how effective has your computer equipment been in the decision, by your customers, to purchase equipment?

*Please mail this form in the self-addressed and stamped envelope provided.

☐ ☒ 5. Please comment on why computers or discounted cash flow analyses are not employed in the analysis of equipment investment alternatives.

WE USE EIA CONSIDERING ALL THE
 INPUT TO BE IN TODAY'S DOLLARS.
 THE MAJORITY OF OUR CUSTOMERS
 ARE NOT FAMILIAR WITH THE DISCOUNTED
 CASH FLOW TECHNIQUE. (IT'S SOMETIMES
 A BIG JOB JUST TO GET THEM UNDER-
 STANDING EIA). HOWEVER, WE DO HAVE
 LARGE MINES THAT LOOK AT DISCOUNTED CASH
 FLOW TECHNIQUES (+PRESENT VALUE ETC) IN EQUIP.
 6. What is your position within the organization? PURCHASER.
 MARKETING SUPERVISOR

*Please mail this form in the self-addressed and stamped envelope provided.

APPENDIX B (Continued)

QUESTIONNAIRE

YES NO

1. Does your organization consider "discounted cash flow" when:

☒ ☐ A. Deciding to purchase/lease equipment?

☒ ☐ B. Assisting customers in the purchase/lease of equipment? - *on occasion*

*If the answers to both of the above were "No", please go to question #5.

☒ ☐ 2. Does your organization employ personal computers for the analysis of equipment investment alternatives?

*If the answer to the above was "No", please go to question #5.

3. Does your organization use:

☒ ☐ A. Caterpillar's Equipment Investment Analysis program?

☐ ☐ B. A customized or local program?

☐ ☐ C. A commercially available program?

☐ ☒ 4. On a scale of 1 to 5 with 5=totally useful, how effective has your computer equipment been in the decision, by your customers, to purchase equipment?

*Please mail this form in the self-addressed and stamped envelope provided.

☐ ☐ 5. Please comment on why computers or discounted cash flow analyses are not employed in the analysis of equipment investment alternatives.

6. What is your position within the organization?

President / Manager

*Please mail this form in the self-addressed and stamped envelope provided.

QUESTIONNAIRE

YES NO

1. Does your organization consider "discounted cash flow" when:

☐ ☒ A. Deciding to purchase/lease equipment?☒ ☐ B. Assisting customers in the purchase/lease of equipment?

*If the answers to both of the above were "No", please go to question #5.

☒ ☐ 2. Does your organization employ personal computers for the analysis of equipment investment alternatives?

*If the answer to the above was "No", please go to question #5.

3. Does your organization use:

☒ ☐ A. Caterpillar's Equipment Investment Analysis program?☐ ☒ B. A customized or local program?☐ ☒ C. A commercially available program?☐ 2.5 4. On a scale of 1 to 5 with 5=totally useful, how effective has your computer equipment been in the decision, by your customers, to purchase equipment?

*Please mail this form in the self-addressed and stamped envelope provided.

☐ ☐ 5. Please comment on why computers or discounted cash flow analyses are not employed in the analysis of equipment investment alternatives.

6. What is your position within the organization?

*Please mail this form in the self-addressed and stamped envelope provided.

QUESTIONNAIRE

YES NO

1. Does your organization consider "discounted cash flow" when:

☒ ☐

A. Deciding to purchase/lease equipment?

☒ ☐

B. Assisting customers in the purchase/lease of equipment?

*If the answers to both of the above were "No", please go to question #5.

☒ ☐

2. Does your organization employ personal computers for the analysis of equipment investment alternatives?

*If the answer to the above was "No", please go to question #5.

3. Does your organization use:

☒ ☐

A. Caterpillar's Equipment Investment Analysis program?

☐ ☐

B. A customized or local program?

☐ ☐

C. A commercially available program?

☐ ☐

3

4. On a scale of 1 to 5 with 5=totally useful, how effective has your computer equipment been in the decision, by your customers, to purchase equipment?

*Please mail this form in the self-addressed and stamped envelope provided.

☐ ☐

5. Please comment on why computers or discounted cash flow analyses are not employed in the analysis of equipment investment alternatives.

6. What is your position within the organization?

Vice President

*Please mail this form in the self-addressed and stamped envelope provided.

QUESTIONNAIRE

YES NO

1. Does your organization consider "discounted cash flow" when:

☐ ☒ A. Deciding to purchase/lease equipment?☒ ☐ B. Assisting customers in the purchase/lease of equipment?

*If the answers to both of the above were "No", please go to question #5.

☒ ☐ 2. Does your organization employ personal computers for the analysis of equipment investment alternatives?

*If the answer to the above was "No", please go to question #5.

3. Does your organization use:

☒ ☐ A. Caterpillar's Equipment Investment Analysis program?☒ ☐ B. A customized or local program?☐ ☒ C. A commercially available program?☐ ☒ 4. On a scale of 1 to 5 with 5=totally useful, how effective has your computer equipment been in the decision, by your customers, to purchase equipment?

*Please mail this form in the self-addressed and stamped envelope provided.

☐ ☐ 5. Please comment on why computers or discounted cash flow analyses are not employed in the analysis of equipment investment alternatives.

6. What is your position within the organization?

FIELD SALES MANAGER

*Please mail this form in the self-addressed and stamped envelope provided.

QUESTIONNAIRE

YES NO

1. Does your organization consider "discounted cash flow" when:

☐ ☒ A. Deciding to purchase/lease equipment?

☒ ☐ B. Assisting customers in the purchase/lease of equipment?

*If the answers to both of the above were "No", please go to question #5.

☒ ☐ 2. Does your organization employ personal computers for the analysis of equipment investment alternatives?

*If the answer to the above was "No", please go to question #5.

3. Does your organization use:

☒ ☐ A. Caterpillar's Equipment Investment Analysis program?

☐ ☒ B. A customized or local program?

☐ ☒ C. A commercially available program?

☐ ☒ 2 4. On a scale of 1 to 5 with 5=totally useful, how effective has your computer equipment been in the decision, by your customers, to purchase equipment?

*Please mail this form in the self-addressed and stamped envelope provided.

☐ ☐ 5. Please comment on why computers or discounted cash flow analyses are not employed in the analysis of equipment investment alternatives.

6. What is your position within the organization?

VP - Information Services

*Please mail this form in the self-addressed and stamped envelope provided.

QUESTIONNAIRE

YES NO

1. Does your organization consider "discounted cash flow" when:

☒ ☐ A. Deciding to purchase/lease equipment?☒ ☐ B. Assisting customers in the purchase/lease of equipment?

*If the answers to both of the above were "No", please go to question #5.

☐ ☐ 2. Does your organization employ personal computers for the analysis of equipment investment alternatives?

*If the answer to the above was "No", please go to question #5.

3. Does your organization use:

☒ ☐ A. Caterpillar's Equipment Investment Analysis program?☐ ☐ B. A customized or local program?☐ ☐ C. A commercially available program?☒ 4. On a scale of 1 to 5 with 5=totally useful, how effective has your computer equipment been in the decision, by your customers, to purchase equipment?

*Please mail this form in the self-addressed and stamped envelope provided.

☐ ☐ 5. Please comment on why computers or discounted cash flow analyses are not employed in the analysis of equipment investment alternatives.

6. What is your position within the organization?

Sales Rep

*Please mail this form in the self-addressed and stamped envelope provided.

APPENDIX C
SENSITIVITY ANALYSIS RESULTS

C.1 TABULATIONS

".8 BASELINE"

Baseline Values==>					
		8,183,277	37.26	0.124	
ITEM	.8*Baseline	0.8 PV	0.8 AT \$/HR	0.8 AT \$/UQ	Baseline (ACRS)
Income Tax Rate %	32	9,166,331	43.03	0.143	40
Investment Tax Credit %	56	8,177,762	38.73	0.129	70
Investment Tax Credit Factor %	40	8,185,289	36.98	0.123	50
Resale Tax Rate %	32	8,185,584	37.15	0.124	40
Insurance & Local Tax %	2.4	8,184,532	37.09	0.124	3
Resale Inflation Adjusted Rate % (prior)	8	8,184,849	37.04	0.123	10
Revenue per Unit of Production	5.6	6,490,228	37.26	0.124	7
Ownership Period (Yrs)	4	6,588,277	36.84	0.123	5
% Depreciation in Period	64	8,183,277	36.98	0.123	80
Selling Price	80,000	8,189,806	37.13	0.124	100,000
Down Payment %	16	8,183,277	37.36	0.125	20
Trade-In Allowance	16,000	8,185,530	36.86	0.123	20,000
Book Value of Trade	16,000	8,181,024	37.75	0.126	20,000
Finance Period (Mos.)	48	8,183,277	36.94	0.123	60
Simple Interest Rate %	9.6	8,183,277	36.93	0.123	12
Resale Value-% of Sell	40	8,180,131	37.68	0.126	50
Annual Scheduled Hours	1,600	6,540,092	37.29	0.124	2,000
Availability %	64	9,826,277	37.29	0.128	80
Hourly Production	240	6,490,228	37.26	0.155	300
Fuel Cost per Unit Volume	0.96	8,200,691	34.66	0.116	1.2
Operator Salary	12	8,195,370	35.46	0.118	15
Fuel Consumed per Hour	14.4	8,200,691	34.66	0.116	18
Oils, Fillers, Grease	3.2	8,186,501	36.78	0.123	4
Estimated Tire Life	800	8,179,245	37.86	0.126	1,000
Tire Replacement Cost	3,200	8,186,501	36.78	0.123	4,000
Undercarriage: "I" Factor	0.16	8,184,889	37.02	0.126	0.2
"A" Factor	0.16	8,184,889	37.02	0.123	0.2
"Z" Factor	0.4	8,187,308	36.66	0.122	0.5
Basic U/C Factor	8	8,190,532	36.18	0.121	10
Repairs: Extended Life Multiplier	1	8,188,315	36.51	0.122	1.25
Basic Repair Factor	4	8,188,315	36.51	0.122	5
Special Items (GET, etc)	1.6	8,184,889	37.02	0.123	2
Debt % of Assets	48	7,842,653	37.26	0.124	60
Cost of Debt %	8	8,336,489	37.26	0.124	10
Return On Equity %	16	8,529,990	37.26	0.124	20
Availability 1st Year %	64	6,540,092	37.26	0.124	80
Availability Last Year %	48				60
Estimated Inflation % (future)	8	7,769,090	37.26	0.124	10
Straight-Line		8,183,519	37.26	0.124	

APPENDIX C (Continued)

"1.2 BASELINE"

ITEM	1.2*Baseline	1.2 PV	1.2 AT \$/HR	1.2 AT \$/UQ
Income Tax Rate %	48	7,175,595	31.48	0.105
Investment Tax Credit %	84	8,188,791	35.79	0.119
Investment Tax Credit Factor %	60	8,181,264	37.54	0.125
Resale Tax Rate %	48	8,180,969	37.37	0.125
Insurance & Local Tax %	3.6	8,182,021	37.42	0.125
Resale Inflation Adjusted Rate % (prior)	12	8,181,704	37.47	0.125
Revenue per Unit of Production	8.4	9,876,326	37.26	0.124
Ownership Period (Yrs)	6	9,756,960	37.53	0.125
% Depreciation in Period	96	8,183,277	37.54	0.125
Selling Price	120,000	8,176,747	37.39	0.125
Down Payment %	24	8,183,277	36.16	0.124
Trade-In Allowance	24,000	8,181,024	37.65	0.125
Book Value of Trade	24,000	8,185,530	36.76	0.123
Finance Period (Mos.)	72	8,183,277	37.58	0.125
Simple Interest Rate %	14.4	8,183,277	37.59	0.125
Resale Value-% of Sell	60	8,186,422	36.83	0.123
Annual Scheduled Hours	2,400	9,826,461	37.23	0.124
Availability %	96	8,183,277	37.23	0.124
Hourly Production	360	9,876,326	37.26	0.103
Fuel Cost per Unit Volume	1.44	8,165,862	39.85	0.133
Operator Salary	18	8,171,183	39.98	0.13
Fuel Consumed per Hour	21.6	8,165,862	39.85	0.133
Oils, Filters, Grease	4.8	8,180,052	37.74	0.126
Estimated Tire Life	1,200	8,185,964	36.86	0.123
Tire Replacement Cost	4,800	8,180,052	37.74	0.126
Undercarriage: "I" Factor	0.24	8,181,664	37.50	0.125
"A" Factor	0.24	8,181,664	37.50	0.125
"Z" Factor	0.6	8,179,245	37.86	0.126
Basic U/C Factor	12	8,176,021	38.84	0.128
Repairs: Extended Life Multiplier	1.5	8,178,238	38.01	0.127
Basic Repair Factor	6	8,178,238	38.01	0.127
Special Items (GET, etc)	2.4	8,181,664	37.50	0.125
Debt % of Assets	72	8,547,932	37.26	0.124
Cost of Debt %	12	8,034,475	37.26	0.124
Return On Equity %	24	7,858,359	37.26	0.124
Availability 1st Year %	96	9,826,461	37.26	0.124
Availability Last Year %	72			
Estimated Inflation % (future)	12	8,616,976	38.18	0.127

APPENDIX C (Continued)

"PRESENT VALUE VARIATION"

ITEM	PV	PV	PV	PV
	\$Variation@.8	%Variation@.8	\$Variation@1.2	%Variation@1.2
Income Tax Rate %	983,054	12.01%	-1,007,682	-12.31%
Investment Tax Credit %	-5,515	-0.07%	5,514	0.07%
Investment Tax Credit Factor %	2,012	0.02%	-2,013	-0.02%
Resale Tax Rate %	2,307	0.03%	-2,308	-0.03%
Insurance & Local Tax %	1,255	0.02%	-1,256	-0.02%
Resale Inflation Adjusted Rate % (prior)	1,572	0.02%	-1,573	-0.02%
Revenue per Unit of Production	-1,693,049	-20.69%	1,693,049	20.69%
Ownership Period (Yrs)	-1,595,000	-19.49%	1,573,683	19.23%
% Depreciation in Period	0	0.00%	0	0.00%
Selling Price	6,529	0.08%	-6,530	-0.08%
Down Payment %	0	0.00%	0	0.00%
Trade-In Allowance	2,253	0.03%	-2,253	-0.03%
Book Value of Trade	-2,253	-0.03%	2,253	0.03%
Finance Period (Mos.)	0	0.00%	0	0.00%
Simple Interest Rate %	0	0.00%	0	0.00%
Resale Value-% of Sell	-3,146	-0.04%	3,145	0.04%
Annual Scheduled Hours	-1,643,185	-20.08%	1,643,184	20.08%
Availability %	1,643,000	20.08%	0	0.00%
Hourly Production	-1,693,049	-20.69%	1,693,049	20.69%
Fuel Cost per Unit Volume	17,414	0.21%	-17,415	-0.21%
Operator Salary	12,093	0.15%	-12,094	-0.15%
Fuel Consumed per Hour	17,414	0.21%	-17,415	-0.21%
Oils, Filters, Grease	3,224	0.04%	-3,225	-0.04%
Estimated Tire Life	-4,032	-0.05%	2,687	0.03%
Tire Replacement Cost	3,224	0.04%	-3,225	-0.04%
Undercarriage: "I" Factor	1,612	0.02%	-1,613	-0.02%
"A" Factor	1,612	0.02%	-1,613	-0.02%
"Z" Factor	4,031	0.05%	-4,032	-0.05%
Basic U/C Factor	7,255	0.09%	-7,256	-0.09%
Repairs: Extended Life Multiplier	5,038	0.06%	-5,039	-0.06%
Basic Repair Factor	5,038	0.06%	-5,039	-0.06%
Special Items (GET, etc)	1,612	0.02%	-1,613	-0.02%
Debt % of Assets	-340,624	-4.16%	364,655	4.46%
Cost of Debt %	153,212	1.87%	-148,802	-1.82%
Return On Equity %	346,713	4.24%	-324,918	-3.97%
Availability 1st Year% & Last Year%	-1,643,185	-20.08%	1,643,184	20.08%
Estimated Inflation % (future)	-414,187	-5.06%	433,699	5.30%
Straight-Line	242	0.00%		

APPENDIX C (Continued)

"AFTER-TAX COST PER HOUR VARIATION"

ITEM	AT\$\$/HR \$Variation@.8	AT\$\$/HR %Variation@.8	AT\$\$/HR \$Variation@1.2	AT\$\$/HR %Variation@1.2
Income Tax Rate %	5.77	15.49%	-5.78	-15.51%
Investment Tax Credit %	1.47	3.95%	-1.47	-3.95%
Investment Tax Credit Factor %	-0.28	-0.75%	0.28	0.75%
Resale Tax Rate %	-0.11	-0.30%	0.11	0.30%
Insurance & Local Tax %	-0.17	-0.46%	0.16	0.43%
Resale Inflation Adjusted Rate % (prior)	-0.22	-0.59%	0.21	0.56%
Revenue per Unit of Production	0.00	0.00%	0.00	0.00%
Ownership Period (Yrs)	-0.42	-1.13%	0.27	0.72%
% Depreciation in Period	-0.28	-0.75%	0.28	0.75%
Selling Price	-0.13	-0.35%	0.13	0.35%
Down Payment %	0.10	0.27%	-1.10	-2.95%
Trade-In Allowance	-0.40	-1.07%	0.39	1.05%
Book Value of Trade	0.49	1.32%	-0.50	-1.34%
Finance Period (Mos.)	-0.32	-0.86%	0.32	0.86%
Simple Interest Rate %	-0.33	-0.89%	0.33	0.89%
Resale Value-% of Sell	0.42	1.13%	-0.43	-1.15%
Annual Scheduled Hours	0.03	0.08%	-0.03	-0.08%
Availability %	0.03	0.08%	-0.03	-0.08%
Hourly Production	0.00	0.00%	0.00	0.00%
Fuel Cost per Unit Volume	-2.60	-6.98%	2.59	6.95%
Operator Salary	-1.80	-4.83%	2.72	7.30%
Fuel Consumed per Hour	-2.60	-6.98%	2.59	6.95%
Oils, Filters, Grease	-0.48	-1.29%	0.48	1.29%
Estimated Tire Life	0.60	1.61%	-0.40	-1.07%
Tire Replacement Cost	-0.48	-1.29%	0.48	1.29%
Undercarriage: "I" Factor	-0.24	-0.64%	0.24	0.64%
"A" Factor	-0.24	-0.64%	0.24	0.64%
"Z" Factor	-0.60	-1.61%	0.60	1.61%
Basic U/C Factor	-1.08	-2.90%	1.58	4.24%
Repairs: Extended Life Multiplier	-0.75	-2.01%	0.75	2.01%
Basic Repair Factor	-0.75	-2.01%	0.75	2.01%
Special Items (GET, etc)	-0.24	-0.64%	0.24	0.64%
Debt % of Assets	0.00	0.00%	0.00	0.00%
Cost of Debt %	0.00	0.00%	0.00	0.00%
Return On Equity %	0.00	0.00%	0.00	0.00%
Availability 1st Year% & Last Year%	0.00	0.00%	0.00	0.00%
Estimated Inflation % (future)	0.00	0.00%	0.92	2.47%
Straight-Line	0.00	0.00%		

APPENDIX C (Continued)

"AFTER-TAX COST PER UNIT QUANTITY VARIATION"

ITEM	AT\$\$/UQ \$Variation@.8	AT\$\$/UQ %Variation@.8	AT\$\$/UQ \$Variation@1.2	AT\$\$/UQ %Variation@1.2
Income Tax Rate %	0.02	15.32%	-0.02	-15.32%
Investment Tax Credit %	0.01	4.03%	-0.01	-4.03%
Investment Tax Credit Factor %	0.00	-0.81%	0.00	0.81%
Resale Tax Rate %	0.00	0.00%	0.00	0.81%
Insurance & Local Tax %	0.00	0.00%	0.00	0.81%
Resale Inflation Adjusted Rate % (prior)	0.00	-0.81%	0.00	0.81%
Revenue per Unit of Production	0.00	0.00%	0.00	0.00%
Ownership Period (Yrs)	0.00	-0.81%	0.00	0.81%
% Depreciation in Period	0.00	-0.81%	0.00	0.81%
Selling Price	0.00	0.00%	0.00	0.81%
Down Payment %	0.00	0.81%	0.00	0.00%
Trade-In Allowance	0.00	-0.81%	0.00	0.81%
Book Value of Trade	0.00	1.61%	0.00	-0.81%
Finance Period (Mos.)	0.00	-0.81%	0.00	0.81%
Simple Interest Rate %	0.00	-0.81%	0.00	0.81%
Resale Value-% of Sell	0.00	1.61%	0.00	-0.81%
Annual Scheduled Hours	0.00	0.00%	0.00	0.00%
Availability %	0.00	3.23%	0.00	0.00%
Hourly Production	0.03	25.00%	-0.02	-16.94%
Fuel Cost per Unit Volume	-0.01	-6.45%	0.01	7.26%
Operator Salary	-0.01	-4.84%	0.01	4.84%
Fuel Consumed per Hour	-0.01	-6.45%	0.01	7.26%
Oils, Filters, Grease	0.00	-0.81%	0.00	1.61%
Estimated Tire Life	0.00	1.61%	0.00	-0.81%
Tire Replacement Cost	0.00	-0.81%	0.00	1.61%
Undercarriage: "I" Factor	0.00	1.61%	0.00	0.81%
"A" Factor	0.00	-0.81%	0.00	0.81%
"Z" Factor	0.00	-1.61%	0.00	1.61%
Basic U/C Factor	0.00	-2.42%	0.00	3.23%
Repairs: Extended Life Multiplier	0.00	-1.61%	0.00	2.42%
Basic Repair Factor	0.00	-1.61%	0.00	2.42%
Special Items (GET, etc)	0.00	-0.81%	0.00	0.81%
Debt % of Assets	0.00	0.00%	0.00	0.00%
Cost of Debt %	0.00	0.00%	*REFI	0.00%
Return On Equity %	0.00	0.00%	0.00	0.00%
Availability 1st Year% & Last Year%	0.00	0.00%	0.00	0.00%
	-0.12	-100.00%	-0.12	-100.00%
Estimated Inflation % (future)	0.00	0.00%	0.00	2.42%
Straight-Line	0.00	0.00%		

APPENDIX C (Continued)

ITEM	"TOTAL VARIATION"		
	PV \$TotVariation	AT\$\$/HR \$TotVariation	AT\$\$/UQ \$TotVariation
Income Tax Rate %	1,990,736	11.55	0.038
Investment Tax Credit %	11,029	2.94	0.010
Investment Tax Credit Factor %	4,025	0.56	0.002
Resale Tax Rate %	4,615	0.22	0.001
Insurance & Local Tax %	2,511	0.33	0.001
Resale Inflation Adjusted Rate % (prior)	3,145	0.43	0.002
Revenue per Unit of Production	3,386,098	0.00	0.000
Ownership Period (Yrs)	3,168,683	0.69	0.002
% Depreciation in Period	0	0.56	0.002
Selling Price	13,059	0.26	0.001
Down Payment %	0	1.20	0.001
Trade-In Allowance	4,506	0.79	0.002
Book Value of Trade	4,506	0.99	0.003
Finance Period (Mos.)	0	0.64	0.002
Simple Interest Rate %	0	0.66	0.002
Resale Value-% of Sell	6,291	0.85	0.003
Annual Scheduled Hours	3,286,369	0.06	0.000
Availability %	1,643,000	0.06	0.004
Hourly Production	3,386,098	0.00	0.052
Fuel Cost per Unit Volume	34,829	5.19	0.017
Operator Salary	24,187	4.52	0.012
Fuel Consumed per Hour	34,829	5.19	0.017
Oils, Filters, Grease	6,449	0.96	0.003
Estimated Tire Life	6,719	1.00	0.003
Tire Replacement Cost	6,449	0.96	0.003
Undercarriage: "I" Factor	3,225	0.48	0.001
"A" Factor	3,225	0.48	0.002
"Z" Factor	8,063	1.20	0.004
Basic U/C Factor	14,511	2.66	0.007
Repairs: Extended Life Multiplier	10,077	1.50	0.005
Basic Repair Factor	10,077	1.50	0.005
Special Items (GET, etc)	3,225	0.48	0.002
Debt % of Assets	705,279	0.00	0.000
Cost of Debt %	302,014	0.00	*REF!
Return On Equity %	671,631	0.00	0.000
Availability 1st Year% & Last Year%	3,286,369	0.00	0.000
	0	0.00	0.000
Estimated Inflation % (future)	847,886	0.92	0.003
Straight-Line	242	0.00	0.000

APPENDIX C (Continued)

"DATA BASE SORT (PV)"

ITEM	PV	Per 20% change
	\$TotVariation	%AvgVariation
Revenue per Unit of Production	3,386,098	20.7%
Hourly Production	3,386,098	20.7%
Annual Scheduled Hours	3,286,369	20.1%
Availability 1st Year% & Last Year%	3,286,369	20.1%
Ownership Period (Yrs)	3,168,683	19.4%
Income Tax Rate %	1,990,736	12.2%
Availability %	1,643,000	10.0%
Estimated Inflation % (future)	847,886	5.2%
Debt % of Assets	705,279	4.3%
Return On Equity %	671,631	4.1%
Cost of Debt %	302,014	1.8%
Fuel Cost per Unit Volume	34,829	0.2%
Fuel Consumed per Hour	34,829	0.2%
Operator Salary	24,187	0.1%
Basic U/C Factor	14,511	0.1%
Selling Price	13,059	0.1%
Investment Tax Credit %	11,029	0.1%
Repairs: Extended Life Multiplier	10,077	0.1%
Basic Repair Factor	10,077	0.1%
"Z" Factor	8,063	0.0%
Estimated Tire Life	6,719	0.0%
Oils, Filters, Grease	6,449	0.0%
Tire Replacement Cost	6,449	0.0%
Resale Value-% of Sell	6,291	0.0%
Resale Tax Rate %	4,615	0.0%
Trade-In Allowance	4,506	0.0%
Book Value of Trade	4,506	0.0%
Investment Tax Credit Factor %	4,025	0.0%
Undercarriage: "I" Factor	3,225	0.0%
"A" Factor	3,225	0.0%
Special Items (GET, etc)	3,225	0.0%
Resale Inflation Adjusted Rate % (prior)	3,145	0.0%
Insurance & Local Tax %	2,511	0.0%
Straight-Line	242	0.0%
% Depreciation in Period	0	0.0%
Down Payment %	0	0.0%
Finance Period (Mos.)	0	0.0%
Simple Interest Rate %	0	0.0%

APPENDIX C (Continued)

"DATA BASE SORT (AT\$\$/HR)"

ITEM	AT\$\$/HR	Per 20% change
	\$TotVariation	AT\$\$/HR %AvgVariation
Income Tax Rate %	11.55	15.5%
Fuel Cost per Unit Volume	5.19	7.0%
Fuel Consumed per Hour	5.19	7.0%
Operator Salary	4.52	6.1%
Investment Tax Credit %	2.94	3.9%
Basic U/C Factor	2.66	3.6%
Repairs: Extended Life Multiplier	1.50	2.0%
Basic Repair Factor	1.50	2.0%
Down Payment %	1.20	1.6%
"Z" Factor	1.20	1.6%
Estimated Tire Life	1.00	1.3%
Book Value of Trade	0.99	1.3%
Oils, Filters, Grease	0.96	1.3%
Tire Replacement Cost	0.96	1.3%
Estimated Inflation % (future)	0.92	1.2%
Resale Value-% of Sell	0.85	1.1%
Trade-In Allowance	0.79	1.1%
Ownership Period (Yrs)	0.69	0.9%
Simple Interest Rate %	0.66	0.9%
Finance Period (Mos.)	0.64	0.9%
Investment Tax Credit Factor %	0.56	0.8%
% Depreciation In Period	0.56	0.8%
Undercarriage: "I" Factor	0.48	0.6%
"A" Factor	0.48	0.6%
Special Items (GET, etc)	0.48	0.6%
Resale Inflation Adjusted Rate % (prior)	0.43	0.6%
Insurance & Local Tax %	0.33	0.4%
Selling Price	0.26	0.3%
Resale Tax Rate %	0.22	0.3%
Annual Scheduled Hours	0.06	0.1%
Availability %	0.06	0.1%
Revenue per Unit of Production	0.00	0.0%
Hourly Production	0.00	0.0%
Debt % of Assets	0.00	0.0%
Cost of Debt %	0.00	0.0%
Return On Equity %	0.00	0.0%
Availability 1st Year% & Last Year%	0.00	0.0%
Straight-Line	0.00	0.0%

APPENDIX C (Continued)

"DATA BASE SORT (AT\$\$/UQ)"

ITEM	AT\$\$/UQ	Per 20% change
	\$TotVariation	%AvgVariation
Hourly Production	0.052	21.0%
Income Tax Rate %	0.038	15.3%
Fuel Cost per Unit Volume	0.017	6.9%
Fuel Consumed per Hour	0.017	6.9%
Operator Salary	0.012	4.8%
Investment Tax Credit %	0.010	4.0%
Basic U/C Factor	0.007	2.8%
Repairs: Extended Life Multiplier	0.005	2.0%
Basic Repair Factor	0.005	2.0%
Availability %	0.004	1.6%
"Z" Factor	0.004	1.6%
Book Value of Trade	0.003	1.2%
Resale Value-% of Sell	0.003	1.2%
Oils, Filters, Grease	0.003	1.2%
Estimated Tire Life	0.003	1.2%
Tire Replacement Cost	0.003	1.2%
Estimated Inflation % (future)	0.003	1.2%
Investment Tax Credit Factor %	0.002	0.8%
Resale Inflation Adjusted Rate % (prior)	0.002	0.8%
Ownership Period (Yrs)	0.002	0.8%
% Depreciation in Period	0.002	0.8%
Trade-In Allowance	0.002	0.8%
Finance Period (Mos.)	0.002	0.8%
Simple Interest Rate %	0.002	0.8%
"A" Factor	0.002	0.8%
Special Items (GET, etc)	0.002	0.8%
Resale Tax Rate %	0.001	0.4%
Insurance & Local Tax %	0.001	0.4%
Selling Price	0.001	0.4%
Down Payment %	0.001	0.4%
Undercarriage: "I" Factor	0.001	0.4%
Revenue per Unit of Production	0.000	0.0%
Annual Scheduled Hours	0.000	0.0%
Debt % of Assets	0.000	0.0%
Cost of Debt %	0.000	0.0%
Return On Equity %	0.000	0.0%
Availability 1st Year% & Last Year%	0.000	0.0%
Straight-Line	0.000	0.0%

APPENDIX C (Continued)

"TOP TEN DATA FOR GRAPHING"

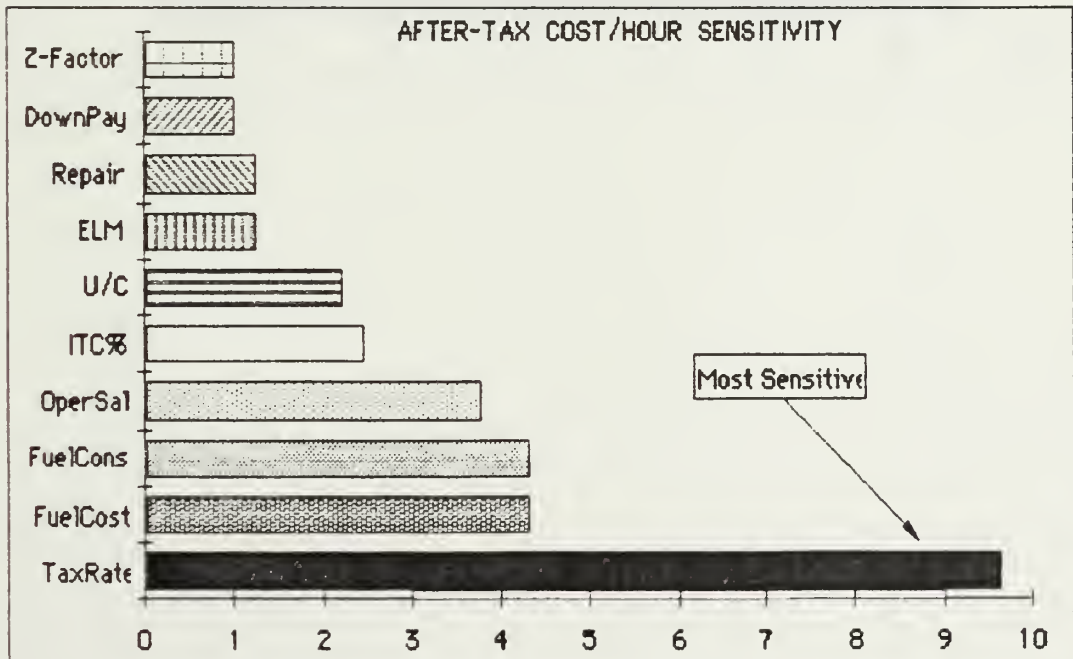
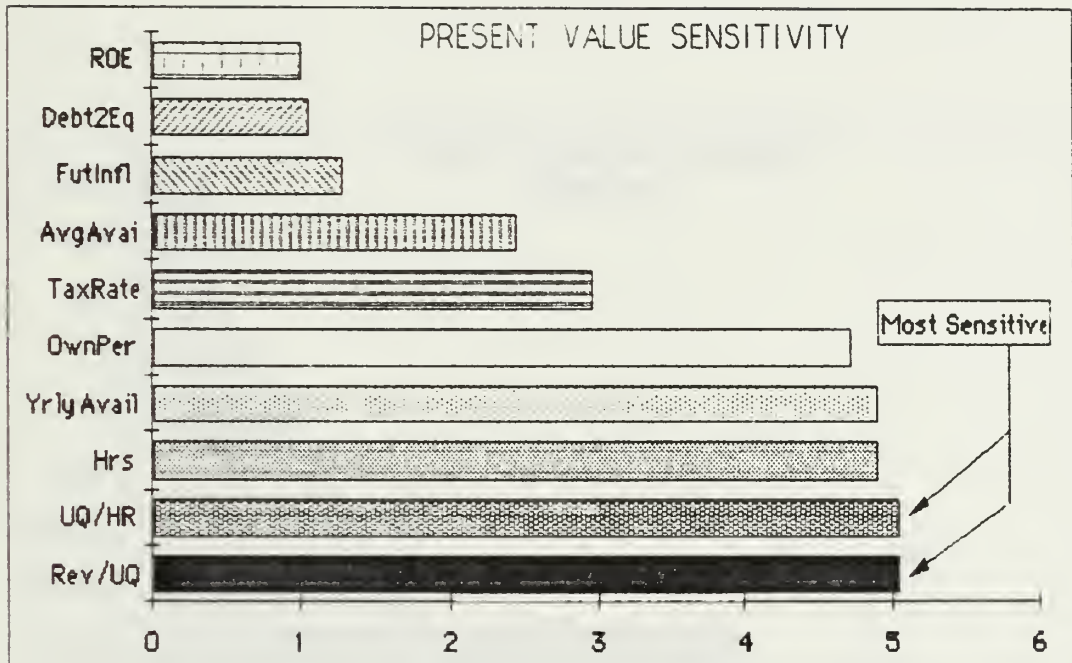
ITEM	PV \$TotVariation	Graph Abbreviation	PV scaled \$TotVariation
Revenue per Unit of Production	3386098.0	Rev/UQ	5.0
Hourly Production	3386098.0	UQ/HR	5.0
Annual Scheduled Hours	3286369.0	Hrs	4.9
Avallabilty 1st Year% & Last Year%	3286369.0	YrlyAvall	4.9
Ownership Period (Yrs)	3168683.0	OwnPer	4.7
Income Tax Rate %	1990736.0	TaxRate	3.0
Avallabilty %	1643000.0	AvgAvall	2.4
Estimated Inflation % (future)	847886.0	FutInfl	1.3
Debt % of Assets	705279.0	Debt2Eq	1.1
Return On Equity %	671631.0	ROE	1.0

ITEM	AT\$\$/HR \$TotVariation	Graph Abbreviation	AT\$\$/Hr scal \$TotVariation
Income Tax Rate %	11.6	TaxRate	9.6
Fuel Cost per Unit Volume	5.2	FuelCost	4.3
Fuel Consumed per Hour	5.2	FuelCons	4.3
Operator Salary	4.5	OperSal	3.8
Investment Tax Credit %	2.9	ITC%	2.5
Basic U/C Factor	2.7	U/C	2.2
Repairs: Extended Life Multiplier	1.5	ELM	1.3
Basic Repair Factor	1.5	Repair	1.3
Down Payment %	1.2	DownPay	1.0
"Z" Factor	1.2	Z-Factor	1.0

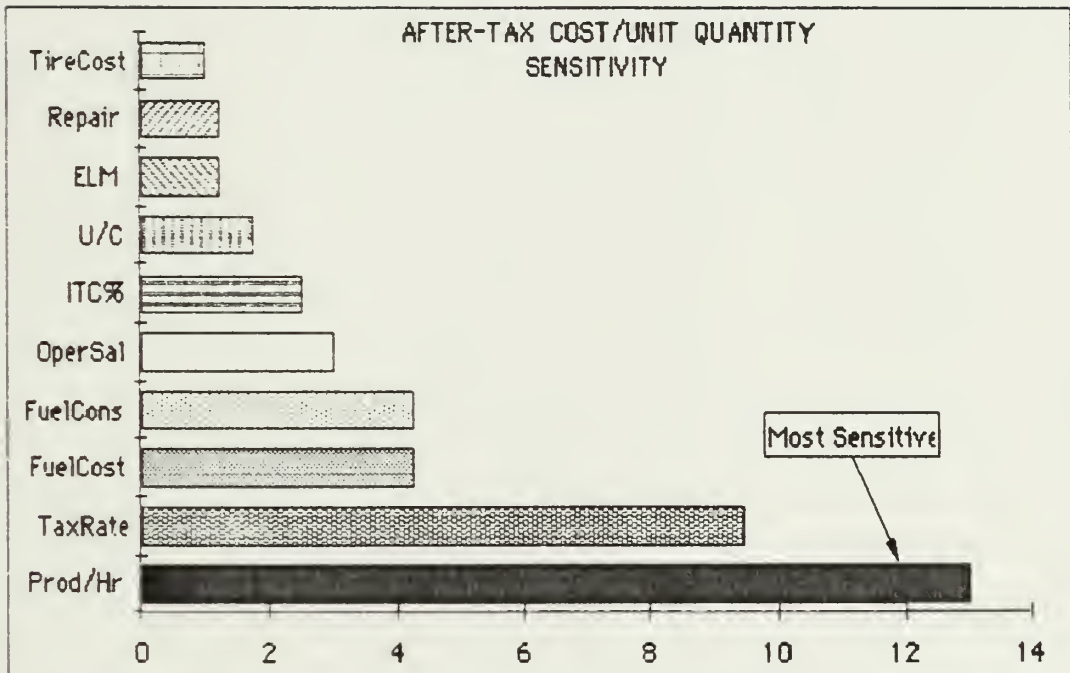
ITEM	AT\$\$/UQ \$TotVariation	Graph Abbreviation	AT\$\$/UQ scal \$TotVariation
Hourly Production	0.052	Prod/Hr	13.0
Income Tax Rate %	0.038	TaxRate	9.5
Fuel Cost per Unit Volume	0.017	FuelCost	4.3
Fuel Consumed per Hour	0.017	FuelCons	4.3
Operator Salary	0.012	OperSal	3.0
Investment Tax Credit %	0.010	ITC%	2.5
Basic U/C Factor	0.007	U/C	1.8
Repairs: Extended Life Multiplier	0.005	ELM	1.3
Basic Repair Factor	0.005	Repair	1.3
Availability %	0.004	TireCost	1.0

APPENDIX C (Continued)

C.2 Graphs



APPENDIX C (Continued)



Thesis

T82235 Trummer

c.1

A study of Caterpillar
Tractor Company's equip-
ment investment analysis
method.

Thesis

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